REPORT OF

IPON TASK GROUP

TO

COMMITTEE

ON

MULTIPLE USE OF THE COASTAL ZONE

APRIL 1969

NATIONAL COUNCIL ON MARINE RESOURCES
AND ENGINEERING DEVELOPMENT

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PREFACE

MISSION

At the direction of the Chairman, Committee on Multiple Use of the Coastal Zone, a Task Group on Identification of Problems, Opportunities and Needs, Existing and Potential (IPON), was convened on April 18, 1968.

The Task Group mission as set forth in the January 23, 1968 memorandum of the Committee on Multiple Use of the Coastal Zone contains the following elements:

1. Review all of the material on this subject which has been prepared by the Council staff, the consultant panels, and others.

2. The first order of business charged to the Task Group was to formulate a list of major opportunities, needs and problems. Subjects should be included on the list on a factual basis without bias or prejudice by the agencies present functions or responsibilities, and to identify whether the situation is national, regional or local in nature.

3. Identify the scientific, technical and economic factors, and seek a model for solution of the problems identified.

4. Develop position papers for consideration of the Committee on a selection of critical issued taken from the listing furnished the Task Group in Enclosure to the January 23, 1968 memorandum, copy of which is attached as Appendix A to this Report. This listing, suggested by the consultative panel at Committee hearings, contains a broad spectrum of items dealing with the following subjects:

a. Quality of the environment.

b. Information base of land and water use.

c. Tendency of Federal action programs aimed at improving undesirable conditions in the Coastal Zone to run ahead of sound knowledge and analysis.

d. Feasibility of regional studies of multiple use programs in the Coastal Zone.

e. Identify specific areas which are threatened with irreversible destruction by developments underway and the drafting of plans to deal with these threats.

f. The need for a framework embracing the conservation, development and research aspects of Federal management of the Coastal Zone.

g. Sewage disposal from U. S. merchant vessels.

h. Consequences of a new sea level Isthmus Canal.

i. Re-examination of the Corps of Engineers shore stabilization techniques and engineering technology.

j. Is the Chesapeake Bay Study proceeding on a sufficiently comprehensive interagency basis?

k. Development of principles and standards for zoning in particular Coastal Zone areas.

l. Possibilities of research support for Committee projects.

m. R & D and control actions needed to combat pollution and hazardous cargo risks from merchant shipping.

n. Explore alternatives to the Corps of Engineers permit system.

o. Formulate acquisition and development programs for marine recreational areas.

5. Basically, both problems and needs are associated with the question of development versus preservation, hence the desirability of working out a national policy on the matter. The Task Group will not only identify problems and needs but work out recommendations on solutions and policies for consideration of the Committee.

METHOD OF APPROACH

The assignment given the IPON Task Group implies an all-inclusive consideration of the Coastal Zone. Other Task Groups and panels were given more explicit assignments, limited to legal aspects, or to physiographic or geographic bounds. The title words "problems, opportunities, and needs existing and potential" direct attention to: (1) the entire store of pertinent knowledge presently available, as well as gaps or unknowns in that knowledge; (2) the background, status, and trends of the cultures involved with the Coastal Zone; (3) the present and aspired degree of technology which can assist in the correction or reconciliation of problems, realize opportunities, and satisfy existing and pending needs.

This report is generalized of necessity. Equally evident, it contains some overlapping with the more specific and detailed considerations of other Task Groups.

An examination of the mission and tasks enumerated in the foregoing shows the subject so broad as to defy completion by the personnel assigned within the four-month's time frame allocated to the Task Group. In order to bring the mission within manageable proportions, discussion by Task Group members and advice received from the Executive Secretary led to the establishment of the following:

1. The study subjects were divided into seven (7) broad topic areas as follows, listed alphabetically:

a. Conservation.

b. Defense.

c. Ecology of wetlands.

d. Food.

e. Mineral exploration and exploitation.

f. Recreation.

g. Transportation and communications.

h. Uses of the shorelines.

2. The end result of the Task Group's work assignment was to develop issue papers presentation to the Committee. Issues are to be decided without regard to priorities or whether they overlap. Primarily, new innocative proposals are to be sought about things in the marine area and the Coastal Zones that are not being done and need to be done. The issues selected should be such as to complete within a four-month period.

3. The first order of business was to list the major opportunities, needs and problems. The plan of attack was to determine what are the uses (areas of interest) in the Resource Base (Coastal Zone), and then determine the needs, after which the problem areas (conflicts) and the opportunities were developed. At the outset, it appeared that in many areas the uses made of the Resource Base resulted in a beneficial effect on other uses. It was decided that these beneficial areas should also be included under opportunities.

4. The geographic area considered by the Task Group was assumed to include the Coastal Zones of the fifty (50) states, where coastal waters are involved, including Hawaii, Alaska, Puerto Rico and the Virgin Islands.

5. The Task Group recognized that problems, opportunities and needs may not be uniformly shared among all sectors of the society, and indeed, the problem of one sector may be that cuased by some other sector. Industrial pollution is but one of the most highly visible current examples of how efficient economic practice may cause a social problem with ramifications that cannot be priced easily in economic terms. The suggestions for formulation of national policy involves insight into the elusive concept of the "public interest" which historically, for lack of a better way, has been defined through presenting competing claims in our democratic political process.

6. Sources of pertinent information are contained in the text and a bibliography is listed in Appendix C. Also, the background and experience of the Task Group members contributed significantly to the material contained in the Report. It should be noted that the background of the members does not include all the areas discussed. Assistance was therefore sought from outside individuals to supplement the Task Group background.

TASK GROUP MEMBERSHIP

1. Membership on the Task Group was variable among those persons listed below, most of whom rotated on or off the Task Group during the four months of prime activity from April to July:

Chairman: (April 18 - July 31)

Captain Raymond G. Miller
Office of Assistant Chief of Staff
U. S. Coast Guard
Department of Transportation
Washington, D. C.

(After July 31)

Captain William A. Jenkins
Deputy Chief, Office of Operations
U. S. Coast Guard
Department of Transportation
Washington, D. C.

Health, Education and Welfare:

Dr. Carl N. Shuster, Jr.
Director, Northeast Marine Health Sciences Laboratory
National Center for Urban and Industrial Health
Narragansett, Rhode Island

Interior:

Bureau of Commercial Fisheries:

Mr. Charles R. Chapman
Acting Assistant Chief, Branch of Shellfisheries
Washington, D. C.

Geological Survey:

Dr. Deric O'Bryan
Social Scientist (Ecological Hydrology)
Arlington, Virginia

Mr. Francis H. Kohout
Staff Hydrologist
Washington, D. C.

National Science Foundation:

Dr. Frank H. Hersman
Staff Associate
Office of Planning and Policy Studies
Washington, D. C.

Smithsonian Institution:

Dr. Grant Gross
Associate Curator
Division of Sedimentology
Washington, D. C.

2. Contributions to the Task Group are also gratefully acknowledged from the following persons:

Dr. Henry L. Berryhill, Jr.
Chief, Office of Marine Geology and Hydrology
Geological Survey
Corpus Christi, Texas

Much of his work on the geological references and treatment of the coast line emanate from his papers "The Coastal Margin, its Nature and Uses."

Dr. William A. Niering
Professor of Botany and Director of the
Connecticut Arboretum
Connecticut College, currently on leave with the
National Science Foundation as Associate Program
Director, Environmental Biology

Dr. Niering's paper on "The Ecology of Wetlands in Urban Areas" is contained herein.

Dr. Jack H. Pierce
Smithsonian Institution

Dr. Pierce prepared the discussion on mineral exploration and exploitation.

REPORT CONTENTS

This Report is divided into the following sections.

1. BACKGROUND

Describes the historical background and cites several current examples which point up problems of conflicting use of certain portions

of the Coastal Zone. Also discussed is the fundamental need to understand our environment, as short and long term changes are taking place, so that our marine science activities may be attained.

2. DEFINITION OF COASTAL ZONE

Briefly describes the physical segments of the Coastal Zone area used for the subject of our study, and defines the term "Coastal Zone."

3. DISCUSSION OF SELECTED AREAS OF INTEREST

Conservation, defense, ecology of wetlands, food, mineral resources, recreation, transportation and communications, and uses of the shoreline are discussed in separate papers in terms of problems, opportunities, and needs.

4. INTERRELATIONSHIPS AMONG USES OF THE COASTAL ZONE

This section lists thirteen (13) use categories, and suggests a methodology for developing a matrix of multiple uses of the Coastal Zone for further study to determine relative use compatibility and incompatibility.

5. COASTAL ZONE LAND DEVELOPMENT POLICY

Discusses the implications of man's use of the shoreline and of certain legal considerations required for Coastal Zone planning, development, and management. There is presented a rationale for a national Coastal Zone land development policy. Certain basic questions, requiring decisions, are posed for consideration in the formulation of a study relating to a Coastal Zone land development policy.

6. RECOMMENDATIONS

The Task Group recommends both a short-term and long-range approach to the Coastal Zone by defining the national policy and goals, establishing a permanent coordinating mechanism of Federal, state, local, and industry for planning, developing, and managing the Coastal Zone, and recommends opportunity for expanded education, training, and research programs.

CHAPTER I

BACKGROUND

INTRODUCTION - THE NEED TO UNDERSTAND MAN'S ENVIRONMENT

Indeed man's distribution and, to a degree, his migration, have been determined by the position of the most definitive and dynamic geographic boundary of our planet - the line along which the land meets the sea. In earliest historical times, the sea beyond the westernmost shores of the Mediterranean was the great abyss of man's ignorance; today the sea floor itself is the latest frontier for man's future economic growth. The coastal margin has become a zone of ever increasing activity as human population has burgeoned; for settlement, for recreation, for industrial development, for mineral production, and for the mass dumping of man's wastes. In the coastal margin and beyond, advancements in technology are leading man to greater involvement with the sea, not just for travel across its surface but for extracting raw materials from its waters and from the sediment and rocks beneath. Consequently, our coast land in the decades ahead will become densely populated, our continental shelves will be explored extensively for resources.

Long before the arrival of the white man in the Northern Hemisphere, American Indians utilized coastal areas as a source of food - seafood, game, and crop growing - and the water as a means for travel. Their mode of living permitted them to leave the immediate shoreline areas seasonally or whenever they sensed danger in weather changes. The pattern of colonization by our forefathers, their mode of living, and their established communities depended upon water power for industry and water routes for communication. These patterns are still reflected in our political boundaries. From this beginning, the coastal areas have had a lasting effect upon political, social, and economic life throughout the United States.

MOBILITY OF THE COAST LINE

Geologic processes have outlined the geographic pattern of earth's surface and the position of the coast line at any given time in earth's history. The nature of the coast line has determined man's use of it. Reconstruction of previous coastal margins is an important task of the economic geologist. Deposits of oil and gas in particular seem to have formed along older coastal margins. Criterion for recognizing older coastal margins are critical to appraising the mineral potential of older sedimentary rocks now exposed on land.

Long-term fluctuations - To the infrequent visitor, the position of the coast line seems eternal. To those more familiar with the coast line, relatively minor changes, but nevertheless of a permanent nature, are apparent during the span of a lifetime, and in some cases over shorter periods. However, in the perspective of geologic time, the entire face

of earth has been remolded many times. The contest of sea against land has raged in slow motion across the globe for at least three billion years; each strives to encroach upon the other in the eternal battle for supremacy.

Our problems of the land and sea are of a much more immediate nature. Consideration of the coastal margin in all its aspects leads us to a few moments of contemplation of man's dilemma if he is forced to fit more people into less land area.

Short-term fluctuations - Short term changes affecting the coastal margin and man's use of it are of two main types: those of periodic or regularly recurring nature such as the tides and seasonal currents; and those of an irregular or catastrophic nature such as hurricanes, tsunamis, and floods. The effect of major hurricanes upon human settlement along the coastline hardly needs reiteration. Suffice to say that during the history of our country, hurricanes and major storms have caused not only changes in the coastline but property and erosional damage along our coastlines whose loss in value can be estimated to be more than a billion dollars - a single major storm not of hurricane proportions that moved along the northeast coast from Cape Hatteras to Maine in March, 1962 alone caused damage estimated at 190 million dollars (Burton and others, 1965). Figures for the number of lives lost in the United States during hurricanes over the past 150 or so years are not abailable, but it would be safe to estimate the total at more than 12,000 by projection from statistics available back in 1888 (World Almanac).

Tsunamis or tidal waves have not been frequent along our coastline, affecting only infrequently the west coast of the United States. However, as a catastrophic event, their effect has, on many occasions, been devastating in other parts of the world. Unfortunately they cannot be predicted, either in time or magnitude. Unlike hurricanes which can be tracked, tsunamis travel at speeds of about 400 mph and there is little time for an alert. The great tsunamis in the Pacific triggered by the explosive eruption of Krakatoa in 1883 caused a tidal wave that drowned more than 36,000 persons in the East Indies and did damage on the western coast of South American 3,500 distant.

Focusing on our immediate presence, man also contributes to short-term changes (vs. geologic time) of his environment as a contrast to the natural short-term changes described in the foregoing paragraphs. For example, the competition for use of certain segments of the Coastal Zone is reflected in the daily press from time to time and cannot be better exemplified than by a newspaper article by Hank Burchard concerning the beach at Ocean City, Maryland, that appeared in the Washington Post, July 14, 1968. It was reported that a legal and political battle is underway to prevent a third or more of the beach at this Atlantic resort from being closed to the public. A private developer has constructed a house that stands on pilings extending into the surf and divides the ten-mile stretch of Ocean City's traditional public beach.

Another article appearing in the Washington Post on July 23, 1968, written by Le Roy Whitman entitled "Maryland Rapidly Losing Wetlands" indicates public concern for the preservation of this valuable natural resource.

An August 15, 1968 dateline out of Annapolis, Maryland states:

> "Construction of an oil refinery on the Potomac River at Piney Point in St. Mary's County, Maryland would post a threat to 50 to 70 percent of the entire annual breeding population of canvasback ducks in the Atlantic Flyway...Other waterfowl species, as well as many additional recreational and fishery resource values could also suffer irreversible harm if this facility is built...It is unfortunate that such a threat should now be posed in a section of the tidal Potomac that is clear and essentially free of harmful pollution, particularly in view of the fact that the upper tidal portion is so badly polluted from sewage and other waste products that enter the river from the Washington, D.C. area."

These words are from Jess W. Malcom, Executive Director of the Chesapeake Bay Foundation. The issue in question concerns a petroleum company's plans for the establishment of a foreign trade zone and the construction of an oil refinery complex at Piney Point, Maryland. The question is now being considered by the Federal, state and local governments, private industry, and interested citizens groups. How or when this question will be resolved is not clear at this time.

Although a start has been made by the Federal government to enhance the exploration, exploitation, and development of our natural resources, and the enactment into law of certain conservation measures, more information is being required by the Congress concerning our water resources, one significant segment of the Coastal Zone.

The House and Senate Appropriations Committees, the Senate Committee on Interior and Insular Affairs, and the Senate Committee on Public Works in recent committee reports have urged more comprehensive analyses of benefits in proposed water resources development projects. These committees are urging that the economic analysis of water projects reflect the broadest scope of potential benefits and costs which would result from their construction and that the committees be furnished data which will accurately reflect all primary and direct benefits as well as indirect and secondary benefits. The purpose of this widespread use and full consideration of all benefits would put this area of public works in a better position to reflect the Nation's goals in economic and social progress.

The foregoing examples are but a few that point up the need to better understand our environment so that the objectives of the marine science activities of the United States, as set forth in Public Law 89-454, may be attained. These are:

1. The accelerated development of the resources of the marine environment.

2. The expansion of human knowledge of the marine environment.

3. The encouragement of private investment enterprise in exploration, technological development, marine commerce, and economic utilization of the resources of the marine environment.

4. The preservation of the role of the United States as a leader in marine science and resource development.

5. The advancement of education and training in marine science.

6. The development and improvement of the capabilities, performance, use, and efficiency of vehicles, equipment, and instruments for the use in exploration, research, surveys, the recovery of resources, and the transmission of energy in the marine environment.

7. The effective utilization of the scientific and engineering resources of the Nation, with close cooperation among all interested agencies, public and private, in order to avoid unnecessary duplication of effort, facilities, and equipment or waste.

8. The cooperation by the United States with other nations and groups of nations and international organizations in marine science activities when such cooperation is in the national interest.

The next section of the Report will discuss in detail the nature of the Coastal Zone in physical terms so that we can appreciate the subsequent consideration of the uses and activities within this area.

THE NATURE OF

THE COASTAL ZONE

OF THE UNITED STATES

We have talked in generalities about the Coastal Zone. But if we are to come to relate the problems, opportunities, and needs to workable programs we must speak in specifics. Hence, this section discusses segments of the Coastal Zone and submits a recommended definition.

Although we considered the Great Lakes area a logical area to include our consideration, it was not included in this report because the Great Lakes area was the subject of a detailed analysis by another Task Group.

INTERACTIONS IN THE COASTAL ZONE

A key to the high biological activity and to physical changes in the Coastal Zone is seen in the tremendous surface of contact among large masses of the interacting natural and living components: the air, water, land, and resources. It is axiomatic that the greater the surface contact and the greater the rate of contact, the greater the action and interaction. This is indeed what occurs in the Coastal Zone. An understanding of this helps us to better visualize a theoretical concept of maximum ecological conditions in the Coastal Zone, and why destruction of a sector of interaction of the components so greatly affects other sectors of the Coastal Zone. The unique thing about the Coastal Zone is the extent of its land-water interface.

PHYSICAL DESCRIPTION OF THE COASTAL ZONE

Suffice for the purposes of consideration by the IPON Task Group, a brief physical description of the various segments of the Coastal Zone is presented, namely:

Continental Shelf
Ocean Shorelines
Estuaries
Estuarine Shorelines
Coastal Wetlands (marshes)
Coastal Plains

Another Task Group, Identification and Delineation of the Coastal Zone, is preparing a separate report, primarily based upon physiological descriptions. Therefore, detailed descriptions are not included here.

DEFINITION OF COASTAL ZONE

It became apparent during the discussions in the Committee of the Multiple Use of the Coastal Zone that a definition was needed. Where the considerations and recommendations involve inter-considerations of the various agencies, Task Groups, and Panels of the Committee a definition of the Coastal Zone is required. Accordingly, an Ad Hoc Working Group was convened by the Committee Chairman to consist of the IPON Task Group and representatives of the Departments of State and Defense (Navy). See Appendix B for details of the report of this Ad Hoc group. The following text is the product of the Committee:

COASTAL ZONE DEFINITIONS

"The Coastal Zone generally comprises the area surrounding the shoreline on the sea coasts, Great Lakes, bays, inlets, and estuaries of the United States, its territories, possessions, Puerto Rico and other areas administered by the United States, whose use is strongly affected by the mutual interaction of land and sea. The objects of research concerning the resources and uses of this area cannot be limited to any specific boundaries. However, for purposes of identifying the immediate objects of planning, management, and regulatory programs, the Coastal Zone extends landward within the states bordering on this shoreline as far as significant marine influences are active, and seaward, to the outer limit of the United States territorial sea. It is emphasized that activities in areas adjacent to the territorial sea may have a significant effect on the use of the shoreline which may require appropriate local, national, or international measures in furtherance of Coastal Zone programs."

PROBLEMS, OPPORTUNITIES AND NEEDS

DISCUSSION OF SELECTED MAJOR AREAS OF INTEREST

The Task Group examined in detail selected separate major areas of interest, as previously listed in the Preface, in terms of problems, opportunities, and needs related to the Coastal Zone. They are:

1. Conservation
2. Defense
3. Ecology of Wetlands
4. Food
5. Mineral Resources
6. Recreation
7. Transportation and Communications
8. Uses of the shoreline

A discussion of each follows.

CONSERVATION

This approach to conservation is basically one of ecology. In Europe the concept of ecology is - in general terms - the influences and reactions of an organism to its environment. In the United States, we place ecological emphasis on what has recently been described as "man's unnatural treatment of nature and its sad results." Comments on pollutions, extinctions, prospects of over-population, and resultant food shortages, make headlines. Inevitably, with technological progress augmenting the conveniences of modern living, and with ingenuity and competiveness utilizing natural resources and changing local environments at an accelerating pace, the principles of ecology must play a significant role in our national programs if we are to preserve and use wisely the natural resources of the Coastal Zone. It may well be the synthesizing approach best suited to the meshing of understanding and compromise between such disparate problems - economic, hydrologic, recreational - which we will encounter in the Coastal Zone.

Problems: Major problems stem from a general indifference or lack of understanding of our environment, except as it can serve our (usually short term) needs and desires.

1. Pollution: Local extinction or decimation of fin and shellfish; limits to recreation; unhealthy habitats; increasing thermal pollution from the rapidly increasing number of power plants.

2. Sedimentation and Erosion: Smothering of shellfish beds and nursery habitats of some fishes is taking place.

3. Lack of knowledge of what resources are contained in the coastal waters (estuaries out to the continental shelf), and can produce without lasting detriment.

4. Lack of attention to urban existence and expansion in seismic and hurricane-prone locations.

Opportunities:

1. Preservation of more specific areas (e.g., Everglades, Cape Hatteras) in a near natural condition for present enjoyment and future planning considerations.

2. Sea harvest (food) research and exploitation - with favorable publicity - of fish meal and other food sources presently held in low public acceptance. The lessening of the numbers of sharks, for example, might increase the numbers and range of the more desirable tuna.

3. Considerations of more offshore rigs, such as the oil platforms in the Gulf of Mexico, Cook Inlet, and off the California coast, for marine research laboratories, pleasure boat havens, and perhaps even waste treatment and disposal plants.

Needs:

Aside from the fact that we have not placed a very high priority on conservation in the past, any ecological change has resulted in multiple and usually permanent reactions. Salmon ceased to run in the Conneticut River and most U. S. West Coast rivers, since the turn of the century. Canals have disrupted the waterfowl and fish habits in the Everglades, in the Great Lakes - and, to be general, in the Mississippi, Colorado and Columbia River deltas.

1. Therefore, we need an appraisal of what we want to save, or sacrifice, not just for now, but for the next several decades. Long Island Sound as a fresh water lake might be an excellent project - but at the sacrifice of major scallop beds. Power plants on a tidal river affect (eradicate) the anadromous fish. Also recent unfortunate oil tanker accidents in marine transportation and oil well blowouts, such as occurred off Santa Barbara, with gross pollution of the waters and beaches must be considered and corrective actions formulated.

DEFENSE

This section on defense is treated in very general terms and is included for the purpose of drawing attention to the fact that defense and national security must be a part of any consideration of the Coastal Zone. No attempt is made in this report to define or discuss problems or opportunities of defense or security since these categories are of such specialized nature and the requirements transcend the parameters and qualifications of the IPON Task Group.

The various statutes and Executive Orders pertaining to preservation and enhancing the environment that are applicable to the Department of Defense, particularly water pollution abatement programs, are being addressed by that department with respect to its own shore establishments and vessels.

The IPON Task Group, therefore, listed some of the obvious general needs pertaining to the marine environment. These would include the following examples:

1. Accurate location of all obstructions and activities.

2. Navigational data such as aids, depths, channels, etc.

3. Practice operating areas including firing and other practice areas.

4. Knowledge of the physical environment, land, sea, and air.

5. Shipyards, bases and other logistic support activities.

It is noted that the Department of Defense is an active participant in the National Interagency Oil and Hazardous Cargo Pollution Plan and is cooperating fully with the various national and regional porgrams under that Plan. Significant elements in the Plan include the United States Army, Corps of Engineers, United States Navy, and Supervisor of Salvage of the Naval Ships System Command and their counterparts in the regional (district) areas.

ECOLOGY OF WETLANDS

Because of the gradual diminishing wetlands of the United States, the IPON Task Group felt that focus on this important segment of the Coastal Zone was in order. Of the materials that were reviewed, a paper presented at the New York Botanical Garden Symposium "Challenge for Survival 1968" by Doctor William A. Niering stated the problem succinctly and well. Doctor Niering proposes that we as a Nation adopt a wetlands policy which will include the preservation of this valuable natural resource. The paper is quoted in its entirety in this report as being applicable to a major problem, opportunity, and need in the Coastal Zone.

THE ECOLOGY OF WETLANDS IN URBAN AREAS*

William A. Niering**

"Man is a threatened species. The twin specters facing him are over-population and unbridled technology - both self-induced.

The double threat is aimed most directly at man's environment. As the United States strives to accommodate more human beings than it has ever had to serve before, increased demands are placed on our natural resource bank. Our surroundings become increasingly crowded, noisy, and soiled."

These opening paragraphs from the Department of the Interior Yearbook Man...an endangered species? echo the grave concern being expressed by certain Federal agencies and Congressmen on the Washington scene. As a nation we have in the 20th century reached a high level of affluence but the environmental price of this progress has been high. Accelerated eutrophication of our lakes and rivers so polluted they occasionally catch fire have rpompted the enactment of Federal water pollution control legislation. But our rapid stride to opulence has also had a drastic impact on other natural landscapes, namely the wetlands. Although the Nation's marshes, swamps and bogs are among the most productive landscapes in the world these liquid assets have suffered greater destruction and abuse than any other natural habitate manipulated by man. As a result of draining, dredging, filling and/or pollution we have in the coterminous United States reduced the nation's wetland asset to 70 million acres, slightly more than half the original acreage (estimated 127 acres). And the destruction is continuing at an accelerated pace of 1% or more per year favored by the pseudo-socio-economic concept that conversion of these habitats into other land use patterns results in the highest and best use. Unfortunately, such decisions have usually been conceived in narrow economic terms with no critical evaluation of the significant ecological role such areas serve the community, the state or the broader national interest.

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* Presented at The New York Botanical Garden Symposium Challenge for Survival/1968, April 25-26, 1968.

** Professor of Botany and Director of the Connecticut Arboretum Connecticat College. Currently on leave with the National Science Foundation as Associate Program Director, Environmental Biology.

It is in this context and that of our symposium Challenge for Survival that I should like to briefly examine their ecological role, the impact of man on their ecology and the action which must be taken to safeguard these assets.

Their Ecological Role

In the urban-suburban complex the remaining wetlands are engulfed by some 140 million Americans crowded onto less than 5% of the land. Yet cattail marshes, wooded swamps and fringing tidal marshes can still persist if given adequate protection from the environmental stresses of urbanization. Unfortunately, to the average urban dweller such areas appear to have little relevance to daily life. For this reason a preview of the ecological role these wetlands serve may be enlightening.

Hydrologic - Wetlands are of major importance in the nation's hydrologic regime. Because of their water holding capacity they act as storage basins assisting in minimizing erosion and serving to reduce the destruction of floods. In cities this is especially important since organization intensifies the rate of run-off as buildings, concrete and asphalt tend to concentrate large volumes of precipitation. Being deficient in soak-in areas the run-off is usually rapid and in excessive volumes. Wetlands, including flood plains, act as catchment basins and tend to slow the speed of flow thus minimizing flood damage. In 1955 when the severe floods struck eastern Pennsylvania hundreds of bridges were washed out along the stream courses. However, two bridges of the type destroyed were left standing below the Cranberry Bog, a natural area preserved by the Nature Conservancy. Flood plains also represent a hydrologic feature ideally designed to carry water during peak flows. Every effort should be made to maintain these valley landscapes free of developments, restricting them for recreation or those activities not incompatible with periodic flooding.

Furthermore, wetlands are important oxidation and sedimentation basins where tons of organic and inorganic sediments are deposited from the urban run-off. Although accelerating eutrophication when intercepted by marshes and swamps the organic component is slowly oxidized and the nutrients made available to the wetland ecosystems rather than being flushed into rivers and streams or the local sewage system.

Marine Productivity - Turning to the coastal wetlands, tidal marshes represent an important marine resource rapidly being engulfed by development. Extremely limited in extent these fringing wetlands are delicately balanced ecosystems that grow upward and landward keeping pace with the constantly rising sea level. Although most of the rise was completed 5,000 years ago it is still occurring at the rate of about 3 inches per century along the Atlantic shoreline. In response to a complex of factors involving salinity there have also developed distinctive belts of marsh vegetation as one progresses from the estuary to the upper marsh border. Located at the break in the slope and at the tidal-fresh water interface there is not only a tendency for sediments to accumulate but also for nutrients to concentrate. Therefore, the marsh-estuarine system is one of the most productive in the world.

In a Georgia salt marsh it has been reported that seven times more protein is produced as in the best Kansas wheat field. Here the food web begins that supports our coastal fisheries. Algae and detritis from the marsh grasses nourish the shellfish. The abundance of plankton and crustaceans provides food for small fish such as menhaden that are consumed by flounder, striped bass and bluefish. These in turn support our spectacular game fish - tuna, marlin, swordfish and sailfish. Here too are the nursery grounds for two dozen or more commercially important crustacea, shellfish and finfish. In fact, it is estimated that 90% of the total harvest of seafood taken by American fishermen is caught on the Continental Shelf and about two-thirds of these species are dependent in part on the marsh-estuarine ecosystem.

Tidal marshes are geologically significant as sediment accretors. When they are destroyed those sediments that are normally deposited on the marsh in its upward growth end up in channels necessitating constant dredging. Their organic carpets of peat and marsh grasses also exhibit great resiliency in buffering the shoreline during periodic storms giving the upland an added degree of protection.

Duck Factories - Although the nation's midwest pothold country produces over 50% of our ducks the eastern coastal marshes around suburbia produce 200,000 and the southern states another 700,000 during the best years. Even though those in the west are most significant as breeding areas all are important including those in and around cities that serve as vital resting and feeding grounds during migration. New York's Jamaica Bay is an excellent example. It should also be recognized that where one is dealing with a migrating resource those wetlands serving as the breeding grounds can affect the waterfowl population and ultimately the hunter or naturalist thousands of miles away.

Education and Recreation - Wetlands are outdoor educational and scientific laboratories. They furnish the resources for scientific research and serve as living museums for teaching the dynamics and ecological role these systems serve. At the Connecticut Arboretum the permanently preserved wetlands have been variously explored by Connecticut College students. A red maple swamp, actually a bog, with its underlying 20 feet of peat served as a challenging problem to an undergraduate as she unravelled the 13,000 years of post-glacial forest history revealed by the pollen preserved in the peat. The Mamacoke tidal marsh salinities studies have been conducted in an effort to better understand marsh zonation and permanent mapping studies will reveal future changes in the marsh vegetation. At the Thames Science Center, closely affiliated with the Arboretum, thousands of school children are annually given first hand field experience and are being taught the value of wetlands. The Arboretum Guided Tour used by the teachers makes its point about the wetland along the route..."The swamp below this dam is roughly an acre in size. If flooded to a depth of one foot, it would hold 330,000 gallons of water. Thus whenever a swamp is filled or drained another large quantity of water is lost from the underground water supply and made to run off more quickly to aggravate flooding problems down stream."

Wetlands also provide many recreational outlets such as fishing, hunting, bird watching or hiking. Twenty million Americans go fishing, two million hunt waterfowl. Thousands hunt with the binoculars and camera where an unparalleled diversity of waterfowl and spectacular marsh birds gives pleasure and inspiration. On Staten Island a unique fenway system has been proposed for incorporating the wetlands as part of the open space pattern. It represents a sound ecological use of resources and the recreation potential is unlimited. Such a mosaic of open space serves as an essential structure to any developing community. It serves an important social function and greatly enhances the quality of the environment.

The Impact of Man:

Filling, Dredging and Draining - In the Merchant of Venice, Shakespeare wrote "... You take my life when you take the means whereby I live." Wetland destruction as a result of filling, dredging and draining has been widespread, especially in highly developed areas. Tidal marshes on the south shore of Long Island Sound have been recuced from 30,000 to 16,000 acres. Similarly along the Connecticut shoreline almost half (45%) of the 36.5 square miles of salt marshes found in the state in 1914 had been destroyed by 1959 and at the present rate of destruction 14% will remain by the year 2,000. At Sherwood Island State Park, Westport, Connecticut 3.5 million cubic yards of gravel were taken from Long Island Sound by hydraulic dredging. Much of this gravel was used in the construction of the Connecticut Turnpike; the remainder obliterated the life of a marsh to create a parking area. Even the site of Kennedy International Airport was once a productive marsh.

Dredging and draining operations can also drastically affect the ecology of wetlands. Dredging causes increased turbidity which decreases light reaching photosynthetic organisms at the base of the food chain. Filter feeders such as shellfish may be adversely affected or actually killed. Suitable hard surfaces for the attachment of larval stages of shellfish may be covered by excessive sediment. The adverse biological effects on wildlife as a result of widespread tidal marsh ditching for mosquito control along the Atlantic coast are well documented. In Delaware natural marsh grasses were replaced by two shrubby species - marsh elder and groundsel. Mollusk and crustacean populations, important food of water fowl and other marsh birds, were reduced up to 95%.

In Florida drainage operations by large corporate developers are threatening the future of Corkscrew Swamp, a magnificant mature cypress forest owned by the National Audubon Society.

One only needs to look within one's own community to see where the sanitary land fill operations are occurring to realize that wetlands are still regarded as wastelands.

Even those wetlands dedicated as natural preserves are being continuously subjected to encroachment. The case of Troy Meadows is a classic example. Located 20 airline miles from Times Square in Morris County, New Jersey, this 3,000 acre marsh half of which is held as a wildlife refuge by Wildlife Preserves is now being subjected to the

following encroachments: two transmission rights-of-way, two gas pipe lines, four sewer lines, a pumping station, three water wells and a dredging operation to speed the flow of odorous effluent from a nearby paper mill. Currently two highways, an interchange and access road are under construction across the preserve. One of the utility easements will be increased in width eight-fold. A pipe line official recently commented to a Wildlife Preserve Officer that this preserve was one of the best things that ever happened for the land is kept open, acquisition is simplified and land is cheap since it is not improved. As long as this attitude prevails our wetlands are doomed. But the question may well be asked - can Troy Meadows, considered one of the finest wetlands in the east, be saved or will these continuing encroachments destroy the values for which the area was preserved?

Pollution - Wetlands have long served as our reservoirs for human and industrial wastes. To these we have added pesticides, "waste" heat and an increased flow of nutrients from agricultural lands. The effects have been to accelerate eutrophication, simplify species diversity and exhaust the oxygen supply leaving only anaerobic organisms. In the Hackensack meadows the tidal marshes are dominated by a single species, reed grass or Phragmites. Here it appears that the more diverse marsh flora has been eliminated by pollution. Although of minor value for water fowl Phragmites still offers shelter and serves to catch sediments and minimize erosion.

Pesticides, especially insecticides, have markedly affected the ecology of wetlands. On Long Island salt marsh muds contain up to 32 lbs per acre of DDT following two decades of mosquito control spraying. Biological magnification occurs at various trophic levels in the food chain from the phytoplankton through the sea birds and levels appear sufficiently high in the marsh muds at this time to be subtly eliminating certain organisms.[1] Marine organisms, especially crustaceans are extremely sensitive to the persistent pesticides. As little as 0.6 to 6 parts per billion will kill or immobilize a shrimp population in two days. A recent court case on Long Island has highlighted this environmental contamination of DDT and has led to a temporary injunction against the Suffolk County Mosquito Control Commission.

The osprey, closely associated with our coastal wetlands, has been rapidly declining in recent years. Here pesticides appear to be implicated. A study from marshes along the Connecticut River now reveals that only 0.5 young per nest are being reared compared to the normal 2.5 young and the eggs contain 5.1 ppm DDT. In Maryland hatchability is slightly better - 1.3 - 1.6 per nest and DDT levels in the eggs are lower - only 3.0 ppm.[2]

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1. Woodwell, G.M., C.F. Wurster, Jr. & P.A. Isaacson. 1967. DDT residues in an east coast estuary: a case of biological concentration of a persistent insecticide. Sci. 156:821-824.
2. Ames, P.L. 1966. DDT residues in the eggs of the osprey in the north eastern United States and their relation to nesting success. Jour. Applied Ecol. 3(suppl.) 87-97.

Probably the most disturbing finding has been the recent report that DDT reduces photosynthesis in marine plankton.3 The ecological implications may be of major significance in modifying species diversity, giving rise to explosive populations and aggravating already serious eutrophication. It may even result in subtle mortalities that might be difficult to determine by even the best sampling techniques.

Need for a National Wetland System

Private agencies such as the National Audubon Society, Nature Conservancy, Wildlife Preserves, Inc., Natural Areas Council and Philadelphia Conservationists have all played a vital role in the preservation of such wetlands as Troy Meadows, the Tinicum Marshes in Philadelphia and East River Marshes in Guilford, Connecticut. The preservation of Great Swamp, although now under federal protection, was initially sparked by a private group of citizens.

At the municipal level we see Jamaica Bay, a famous 3,000 acre marsh and water complex as part of the New York City Park System. And in Hempstead, Long Island 10,000 acres of tidal marshes owned by the town have been dedicated to wetland conservation through a joint program with the state. In the town of Woodbridge, Connecticut there is zoning prohibiting the destruction of wetlands. Many towns have conservation commissions assisting in the preservation of the community's open space resources, especially the wetlands. Land trusts are also being established as in Guilford and Madison, Connecticut where wetlands can be privately held or given to the town with certain legal restrictions.

Two states, Massachusetts and Rhode Island, have taken bold leadership in preserving tidal wetlands. The Massachusetts law prohibits dredging and filling the 45,000 acres remaining in Massachusetts. The Rhode Island law restricts use of coastal wetlands for the benefit of public health, marine fisheries, wildlife and other conservation purposes. In New York the Long Island Wetland Bill provides funding up to 50% of the total cost of development and 50% of total cost of maintenance of town or county owned lands which have been dedicated for conservation purposes. Wetland legislation has been unsuccessful in Connecticut. However, Save the Wetlands Committee has a wetlands acquisition program underway.

At the federal level recent estuarine legislation has authorized the Department of the Interior to inventory the nation's estuarine resources and set forth recommendations for a program of preservation. The Committee on Environmental Quality of the Federal Council on Science and Technology is currently considering means of resolving inter-agency conflicts in the use of the wetlands. Although there is a recognition of the problem much bolder action is required if our wetland heritage is to be saved.

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3. Wurster, C.J. Jr. 1968. DDT reduces photosynthesis by marine phytoplankton. Sci. 159:1474-1475.

In conclusion I should like to propose that we as a nation adopt a national wetlands policy. It is now recognized by economists that our productivity potential has reached such a level that the nation's economy and our high standard of living will not suffer by the preservation of such natural resources but also enhance the quality of life for all Americans. Such a policy would give national recognition to the importance of wetlands. They would be inventoried, evaluated for the ecological role they serve and vast acreages preserved in the national interest. Such a system might be patterned after the Wilderness system so that it could be defended against competitive land uses. This policy would hopefully minimize conflicts of interest among government agencies and exercise certain controls over the private entrepreneur who may destroy for personal gain a resource of great value to the nation.

Until we have fully assessed these liquid assets we will be unable to determine what is the desirable wetland mix that should receive permanent protection. With the possibility of our population doubling within the next 40 years, this is the decade for action. For the urban environment it will mean increased open space, maximum habitat diversity and assure a higher level of environmental quality in perpetuity.

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4. Krutilla, J.V. 1968. Balancing extractive industries with wildlife habitat. Resources for the Future, Inc., Washington, D.C.

FOOD

Introduction

Conflicts between development or preservation of natural coastal habitats for food production are minor compared to non-food activities which physically destroy or chemically poison these habitats. Chief among the destructive activities are: (1) use of coastal areas for chemical, sewage, and solid waste disposal, (2) oil spillage, (3) channel dredging and spoil operations, (4) thermal pollution, and (5) creation of waterfront real estate. The primary National concern regarding food production must be, therefore, the prevention of habitat destruction or, at least, reduction of losses to the lowest amounts possible. Important segments of National policy in this regard are the Federal Water Pollution Control Act (P. L. 88-660) which deals with pollution in coastal areas particularly as it affects shellfish and the Clean Water Act of 1966 which provides for a comprehensive study of the effects of pollution on all estuarine areas and resources.

Development

Fishing has often been labeled, in comparison with modern agriculture, as still in the "hunting" stage. There are major advances being made, however. The Russians, for example, have done well with large cooperative fishing fleets and the Japanese have established themselves as the foremost aquaculturalists of the world. The Japanese have been singularly successful in large scale production of oysters by 3-dimensional culture methods and in salt pond cultivation of shrimp. Economic and political motivation and restraints are probably the major barriers to aquaculture in the United States today.

Four aspects of coastal aquaculture must be considered in long-range planning: (1) selected food species, (2) improvement in and use of culture techniques, (3) construction of artifical habitats, and (4) utilization of non-toxic or non-lethal levels of certain pollutants to enhance food production.

Biomass utilization vs. species production. Intensive aquaculture will depend upon "farming"specific crops, much as in agriculture. Concurrently, production of fish meals and FPC (fish protein concentrate) may be less specied dependent.

Shellfish culture. Although shellfish (molluscan and crustacean) culture techniques have been known for many years, particularly through developments in our research laboratories, we have been slow to utilize this knowledge. The slowness of Americans to adopt and adapt these techniques to commercial enterprises undoubtedly has economic bases related to such factors as the relative ease of present day harvesting, availability of other protein foods, and high costs of aquaculture in comparison to the production of other foods. As shellfish and fish stocks become depleted and the need for food increases, the economic justification of aquaculture will emerge - but the techniques are generally available now. The major concern is whether coastal areas will still be available and of good quality (for sustaining organisms) when aquaculture

becomes a necessary reality. The question of water-land rights vs. the "public domain" will also need resolution.

Construction of culture facilities. When coastal areas can be owned outright or leased on a long-term basis, private enterprise will be more apt to construct artificial habitats conducive to the culture of particular species. In contrast, artificial reefs to attract and maintain fish populations for recreational-food fishing will probably be developed and managed by state (public) agencies.

Environmental manipulation. Large-scale manipulation of the marine environment has been visualized. One recent example involves the use of waste heat from a nuclear power plant to pump nutrient-rich bottom water up to the sunlit surface area. It is predicted that such a thermonutrient pump will greatly increase the fish yield. Because of their coastal location, desalination plants could be coupled with these thermal pumps. Also, with large coastal metropolitan areas looking toward the open ocean as a sewage waste dumping ground, proper management of this waste material might also be beneficial although it is recognized that sewage has limitations, compared with other substances, as a plant nutrient.

Preservation

Although preservation involves maintenance of natural tracts of coastal waters and lands, the major action required to preserve these areas for food production is that of counteracting chemical and physical destruction of natural habitats. If the destructive forces can be restricted, minimized, or halted, then we will have an opportunity to utilize coastal areas for food production. If not, the immediate inshore areas, particularly estuaries, will be doomed much like Lake Erie.

Contaminants can be particularly insidious since they may enter coastal waters in very low concentrations yet ultimately be accumulated many-fold by marine organisms. Contaminants such as pesticides and trace metals destroy food resources either by outright killing the food "crops" or by rendering them unfit for human consumption. This must be prevented! While certain sites may be developed for intensive aquaculture, larger areas will probably remain in the public domain and provide recreational opportunities, including sport fishing. In this respect, large tracts of natural habitats will undoubtedly have to be maintained. Also, as practiced in land maintenance and restoration (reforestation, soil conservation, etc.), management of coastal areas will be needed to enhance their natural aspects. For example, preservation of tidal marshes may someday extend to construction of new tidal habitats that can replace former fish nursery areas that have been destroyed. Thus, preservation of natural coastal habitats will also involve reclaiming areas as well as renewing resources and resource areas.

MINERAL EXPLORATION AND EXPLOITATION IN THE COASTAL ZONE AND ITS EFFECT ON MULTIPLE USE OF THE COASTAL ZONE

Mineral exploration and exploitation is not new to the Coastal Zone, having been carried on as adjunct to land operations for a considerable length of time. Many of the operations in the foreseeable future will be merely ex-

tensions of present day operations, with few radical innovations in technology expected. Exploitation of natural resources has, in some cases, sufficient history so that the associated problems can be defined and precautions taken to minimize their effect.

Mineral industries are used herein in the broad spectrum to include not only exploration and exploitation of solid materials and hydrocarbons but to include also exploitation of materials which are extracted directly from the water mass.

Any activity of the mineral industries have profound effects upon other uses of the Coastal Zone; some of which are incompatible while others are of a positive nature. Although such activity is incompatible, priorities, on behalf of the national interest, should be made, or suggested, in view of our diminishing natural resources on land.

The following groupings are believed to cover the major part of the foreseeable mineral activity in the Coastal Zone in the light of present technology and economics. Exploration and exploitation are discussed only in a general framework with no predictions made as to where mineral activity will occur nor with details as to specifics.

Oil and Gas

Exploration for, and exploitation of, oil and gas resources in the Coastal Zone, as defined, has been carried on since the 1920's. Problems associated with this industry should be relatively well known by now and can be reasonably defined and anticipated. Few radical innovations are expected in this industry which will have an effect upon multiple use of the Coastal Zone. Those technologic changes that may take place will be less expensive refinements in present procedures. Such changes might be use of atomic energy and use of floating rather than fixed platforms. The latter may permit the industry to expand its technologic limits to the outer edge of the continental shelf.

Exploration for oil and gas, with todays' technology, is not deleterious to most other uses of the Coastal Zone. Temporary dislocations may occur in the natural environment due to introduction of some pollutants, use of explosives, and erection of platforms. Temporary discomfiture may result to the recreation industry but no longer term effects should result.

The greatest conflict for exploration will be in the area of national defense. Permanent defense installation on the sea floor may be temporarily blinded by exploration efforts. Denial of the rights of passage may be made by the Department of Defense where exploration impinges upon permanent installations or where the Navy has submarine operating and maneuver areas.

Successful exploration, resulting in the discovery of commercial hydrocarbon deposits, poses a much greater threat to multiple use of the Coastal Zone. Pollutants, in large quantities, is an ever-present threat both to the natural environment, to recreational uses, and to urban uses. On an open shelf, such pollutants would eventually be dispersed by natural agents and, over the long term, harmful effects would be most noticeable on organisms with long residence time. In an estuarine system, such pollutants could effectively poison

the estuary for long periods.

Exploitation of oil depostis can have harmful side effects, not generally considered. Withdrawal of large quantities of oil can cause subsidence of superjacent land and flooding of former land areas. Such flooding would be serious to urban development, as is now being experienced near Long Beach, California.

On the positive side, installations placed upon the seabed could, if pollutants were carefully controlled, act as artificial reefs. These would enhance the recreational aspects of the Coastal Zone. In the broadest aspect, such reefs might possibly act as focal points for aquaculture. It is generally known that increases in fishery activity off the Louisiana coast has been attributed to the reef effect of oil wells. It might be worthwhile to investigate this possibility in conjunction with private industry.

Solid Materials

Included in this category are those minerals occurring as solid particles on the floor of the sea, in beach deposits, or in rock layers making up the floor. These comprise presently exploitable, or near economic, deposits of sand and gravel, phosphate, titaniferous and ferrous minerals, heavy metals, and diamonds. Methods of exploitation are similar for all of these as well as other minerals solids which might be included.

The present processes, and probably those of the near future, are analogous to land mining where large quantities of a matrix and associated minerals are removed, the minerals extracted, and the matrix either placed in spoil dumps or returned to the environment. Present methods often leave large unsightly deposits behind and are incompatible with multiple use of any area. Underground mining can return most of the matrix to the mined out tunnels thus greatly reducing most of the spoil dump problem. Strip mining, or varieties, thereof, will pose the greatest problems.

Immense quantities of sediment will be placed in suspension, if the deposit is under water, and the environmental factors changed rather drastically. The benthic fauna will be destroyed by the dredging and the fauna living in the water mass either destroyed or driven away due to turbidity. If the deposit is a beach, mining will destroy the beach for recreation purposes and could introduce sediment into the water creating environmental changes. Surface supplies of fresh water could also be contaminated in a similar manner.

Mining methods often require large volumes of fresh water. Withdrawal of this from the aquifers may deplete city water supplies or cause salt water encroachment into the aquifers. Withdrawal of large volumes might also cause small scale subsidence and fracturing of the overlying impermeable beds permitting flooding of the aquifer with salt water.

Sand and gravel are deposits often overlooked in resumes of mineral deposits although the value of these commodities exceeds many of those that are often considered. Sand and gravel from offshore deposits are now being used for beach replenishment in Florida. In some coastal areas, lack of such deposits on land may require the exploitation of such material as raw materials for

construction of buildings and roads. Massive use of these deposits would undoubtedly upset the biologic and physical systems that presently hold in the area.

Removal of sand and gravel from offshore reserves would be disastrous to the benthic biota and would, in no small way, effect the physical regime of the coast. Removal of large quantities for purposes on land may have deleterious effects over sections of the coast much larger than the area immediately adjacent to that which was mined.

Chemical Products from Sea Water

Present extraction processes for elements from sea water do little to change the overall chemistry of the water mass. Those presently being extracted on a commercial basis are neither the major elements nor those considered as nutrients and absolutely necessary for life processes. Some amount of these elements are undoubtedly necessary in the life processes of certain marine forms, e.g. magnesium which is incorporated into the shell structure of clams.

The effects are believed to be local in extent. The deficiency of elements due to the extractive process is undoubtedly soon made up by natural mixing of the water masses. Dow Chemical supposedly processes somewhere in the neighborhood of a billion gallons of water per day in its Freeport, Texas plant. The effect of this plant does not seem to cause alarm.

Certain metals in the effluent, taken from metal surfaces over which the water passes, may be harmful in a very local area.

The temperature of the water is raised somewhat during processing causing the effluent to be at a higher temperature than the intake water. This is not entirely detrimental.

Desalinization

This section is abstracted from Office of Saline Water Progress Report 197, Mineral By-products from Saline Waters, and Report 316, Study of the Dispersal of the Effluent from a Large Desalinization Plant.

Erection of large desalinization plants will create conditions, under present technology, which are detrimental to the biota and to the recreational aspects of the immediate area. In the foreseeable future, very little in the way of chemicals will be extracted as by products of desalinization plants.

The effluent from presently operating plants has a salinity between 50°/oo and 60°/oo against normal sea water with 35°/oo. Future plants will have an effluent stream whose salinities range from 1.05 to 1.10 times normal. In addition to the increased salinity, there will be an increase in temperature; a depletion in oxygen; decrease in alkalinity and pH; it will be chlorinated; and it will contain toxic amounts of heavy metals, phosphates, and chemical additives. Toxic amounts of ionic copper, on the order of 20 times normal, will be the most deleterious substance. There may be an increase in turbidity.

All of these increases cited, however small they seem, will have a marked effect on the local marine environment. Organisms with long residence times, the benthic adults and larvae and the zooplankton, will be seriously affected. Damage may be alleviated, but not halted, by proper design of the intake-outfall structures to promote mixing.

The total effect on all factors will be to reduce the usefulness of the area for other benefits. Some of the effects will be to kill marine plants and animals, cause objectionable orders through secondary effects, permit extension into area of unwanted species, increase productivity of low level forms which lead to aesthetic nuisances and health hazards, promote eutrophication, produce fog or sea smoke, production of H_2S and increased corrosivity, and concentration of copper by phytoplankton to filter feeders to such an extent as to be lethal. These effects have bearing on recreational use, on wildlife, on municipal and industrial use of water, and on transport and navigation. Nearly all effects are detrimental.

The Office of Saline Water is aware of the problems and is attempting to solve many of them by design of the desalinization plants and location where effects can be minimized. Siting of a plant in an estuary, or other water body with a poor circulatory system, would be catastrophic. Obviously more, much more, data will be needed before the true effect on all levels of life and the geographic extent can be predicted. Biologic data, for background, should be gathered now on areas that are potential sites for desalinization plants.

Mineral by-products from saline water does not figure to be of significant commercial value in the very near future. Present pretreatment processes, to reduce scale formation, result in a high-analysis fertilizer. This can be marketed economically only where there is a local demand for fertilizer and no nearby sources exist.

To date, only the economics of the recovery of potassium and sodium sulfates, from desalinization effluent, has been investigated. The break-even point for sodium sulfate and potassium sulfate for a hypothetical plant is $8 per ton. Present selling price is approximately $28 per ton resulting in a commercial operation.

Extraction of other minerals may be feasible. The high content of copper, as well as the increased salinity, may make extraction of copper, magnesium, and bromine feasible. The desalinization plant at Freeport, Texas feeds effluent into the Dow Chemical plant for extraction of magnesium from the water.

RECREATION

Introduction

The demand for coastal outdoor recreation is part of a greater national requirement. However, because about one-third of our populace reside within 50 miles of the seacoast and travel from much greater distances has become routine, the coastal areas must provide for much of the nation's outdoor recreation needs. And these needs are diverse, subject to considerable

variation in seasonal and regional demands, and growing as our population becomes larger, incomes increase and working time shortens.

The Issue

To provide opportunity for diverse, high quality coastal outdoor recreation to satisfy current and future needs of the American people.

The Problem and Discussion

As the demand for coastal outdoor recreation grows, high quality coastal areas and coastal fish and wildlife resources diminish.

Estuaries, coastal lagoons, beaches, in fact all types of coastal areas suitable for recreation are subject to the impact of man. Pristine areas are converted to residential, commercial and industrial sites. Private ownership usually denies public access. Coastal marshes are drained for insect control and filled to make elevated real estate. Rivers are dammed and diverted, highways crisscross the landscape, and great metropolitan units occupy once suitable recreation areas. Estuaries have become the receptables for human and industial wastes and agricultural runoff contaminated with pesticides. Many coastal areas have been diked and levied to provide storm protection and to "reclaim" unoccupied shorelines and marshes.

Almost all of our coastal areas are experiencing an increased demand for many purposes. Yet, it is these areas that must provide for much of the Nation's recreation needs. Daily, the need grows for more, not less, high quality recreation and for more fish and wildlife resources. Meeting the national need for coastal outdoor recreation truly is a great challenge.

So far, development of much of the Coast Zone generally has been of single purpose for short-range goals; virtually no thought has been given to other uses or for future needs. Planning has been talked about but not generally practiced. In many parts of our country, high quality coastal areas suitable for a variety of recreational pursuits is but a dim memory; and more of our coastal areas are being converted daily to such a memorable status. The trend, however, is beginning to change. Public awareness is causing us to assess the present state of affairs and to look ahead. Too long, the public interest and need for high quality recreation has not been satisfied; certainly planning for future recreation needs in 10,50, or 100 or more years virtually has been ignored. However, it is gratifying to note that planning for future water-based recreation is a significant part of the extensive Type 1 planning program of the Water Resources Council, and that the Bureau of Outdoor Recreation also does considerable long-range recreation planning. The recent Coast Guard's expanded program of recreational boating safety is looking ahead to make this form of recreation a safer sport.

Planning to provide for suitable high quality coastal recreation must also consider the needs of other uses of the Coastal Zone, including transportation and communications, food production, mining, defense, shoreside industry and urbanization, and conservation of the coastal environment. Coastal recreation needs must be considered an integral part of national multiple-use planning and management of the Coastal Zone.

The Needs

Before a rational plan to provide for coastal outdoor recreation can be developed, several steps would be necessary. These are:

1. Identify national and regional needs for various types (see attached list) of coastal outdoor recreation now and for the future.
2. Determine to what extent and where these needs now are being fulfilled.
3. Determine where additional recreation areas and facilities of various types can be developed.
4. Explore how additional recreation can be provided at national, regional, and local levels.
5. Develop cost estimates and justifications.

Only after the above steps have been completed will it be possible to devise a long-range action program, as part of a national multipel-use development and management plan, to assure that sufficient high quality areas, facilities, and fish and wildlife resources are provided to meet the recreation needs of the American people. Types of coastal outdoor recreation of interest to our people are as follows:

1. Fishing
2. Boating/sailing
3. Swimming
4. Skin diving
5. Surfing
6. Water skiing
7. Sun bathing
8. Camping
9. Picnicking
10. Hiking
11. Collecting (shells, etc.)
12. Hunting
13. Photography
14. Bird watching
15. Sight seeing
16. Treasure hunting
17. Nature study
18. Environmental enjoyment (relaxing)

TRANSPORTATION AND COMMUNICATIONS USES IN THE COASTAL ZONE

This category of uses in the Coastal Zone includes the vast transportation industry involved in the movement of goods and people for commercial, and other reasons, either on, over, or beneath the surface of the water. Other marine related categories of use in the Coastal Zone area would include vessels supplying offshore drilling platforms, fishing vessels when traveling to and from the fishing areas, and pipelines and communication cables which are laid on the bottom or trenched below the bottom of the seabed.

It should be noted that the Department of Transportation Act 1966 (P.L. 89-670), Section 4(f) requires that the Secretary shall not approve any program or project which requires the use of any land from a public park, recreation area, wildlife and water fowl refuge, or historic site unless there is no feasible and prudent alternative to the use of such land and that such program includes all possible planning to minimize harm to these areas. Hence, in the development of programs and projects involving the transportation needs, enumerated in the subsequent discussion, the foregoing parameters are prescribed.

The Act establishing the Department of Transportation included among its purposes the task "to assure the coordinated, effective administration of the transportation programs and to provide general leadership in the identification and solution of transportation problems."

The Secretary, on 27 January 1968, designated the Coast Guard as the representative of the Department for carrying out the purpose of the Department of Transportation Act with respect to waterways, ports, and harbors. He further enjoined the Coast Guard to assume the developmental role "limited to a two-way communications system to establish a departmental presence in the day-to-day operation of the maritime industry." Accordingly, Coast Guard concern is now being further projected into the total marine transportation activity to fullfill the purposes of the Department. Herein, therefore, lies the opportunity for both the Coast Guard and industry to make full use of this new Federal mechanism in terms of problems, opportunities, and needs of the users of the Coastal Zone.

Problems

One current problem recognized by both government and industry is that of port modernization and development. Particulary this problem has been brought about by the increased maritime traffic caused by the increasing demand for goods and services by our growing population, great mobility of our people traveling both at home and abroad in business and pleasure, the outmoded and aging piers and water-front structures, and changing technology and containerization of cargo, supertankers carrying mammoth quantities of oil and new exotic chemical carriers transporting such cargoes as liquified and refrigerated gases.

In recognition of these problems and the need for port modernization, the Committee on Multiple Use of the Coastal Zone formed a Task Group to develop a conceptual plan for regional port studies. This Task Group, comprised of representatives from the Department of Army (Corps of Engineers), Department of Transportation (Coast Guard), and the Department of Commerce (Maritime Administration) has submitted its report to the Committee. Therefore, the IPON Task Group merely makes reference to this work and acknowledges and supports the need for such a coordinated approach to port development. The specific needs of transportation and communications include:

1. Accurate bottom contours of the coastal waters must be determined and charts giving the depth and type of bottom are required. All obstructions or restricted areas of operation must be indicated so that the surface and subsurface units may be safely navigated.
2. Channels and turning basins must be dredged into various ports to permit movement of various size vessels.
3. Surface aids to navigation including buoys and fixed structures must be provided.
4. Sea lanes to permit minimum risk of collision must be provided.
5. Fairways through obstructions such as offshore drilling platforms must be provided. These must be such as to minimize the distance through the obstruction area, wide enough to permit unrestricted speed limits and properly marked on the charts.
6. Anchorage areas must be provided.

7. Shore facilities for the loading and dischargeing of cargo and passengers must be provided. Facilities are also needed to provide fuel, water and food for the transportation units. Facilities needed include storage areas and transfer areas for truck, aircraft, and rail.

8. There must be means for disposal of waste and trash from those units and for the disposal of waste created when tanks are cleaned.

9. Facilities must be provided for overhaul (maintenance and repair) of the transportation units.

10. Means for providing assistance to those units in time of emergency is necessary. This is required not only for the protection of life and property but to prevent contamination of the area due to pollution.

11. The pipelines and communication cables must be laid in such a manner to protect them from damage, and to preclude their being a hazard to navigation.

12. Units operating under the surface must be provided with sufficient information on subsurface conditions to insure safe navigation. Wrecks and abandoned vessels may have to be removed.

13. Aids to navigation for the subsurface units must be provided.

14. Special resuce equipment for submersible vessels must be developed and provided.

15. Offshore terminals for deep draft ships must be developed and constructed.

16. Small vessels need Harbors for Refuge.

17. Highways near and over the water, including necessary bridge clearances, must be sufficient to provide ready access to the transportation and related facilities.

18. Airports in the Coastal Zone will continue to be required.

19. Railroads near and over the water area, including necessary bridge clearances will continue to be required.

20. Seaplane landing areas must be provided although the need for such areas are diminishing.

21. Port development and dispersion, including facilities for handling of dangerous cargo, must be provided.

22. Facilities of rescue and emergency equipment, including boats and aircraft, will be required.

23. A growing need for an increased number of traffic control stations, or harbor approach radar systems is probable.

Transportation interests, especially air and water modes, pose requirements for marine and atmospheric science, technology, and services will have to be such to keep pace with the increasing complexity and sophistication of transportation systems operating over, on, and under the oceans.

USES OF THE SHORELINE

General

In the earlier periods of national growth and development, the nature of the shoreline largely dictated its use. Thus the natural deep harbors of the northeast and west coasts gave rise to shipping as a major enterprise. Settlement was most rapid in those parts of the country that had good access to the sea as a trade route. The nature of our coast lines established a pattern of growth and development that is still felt today - the settlers of the rocky sea coasts looked to the sea, the settlers in parts of the country

with sandy coast line and poor access to the sea turned inland.

Increased activity along the coast line has brought increased confrontation between man and the sea and with greater involvement have come the modifications that man has felt must be made to make the use of the sea more convenient. Shipping, industrial development and settlement have caused man to make major modifications in the natural setting of the shoreline. These have brought about drastic changes in the environmental balance of the coastal margin.

The need for outlets to the sea along the coastal sandy plains has meant the cutting of artificial passes through estuaries, bays, lagoons, and barrier islands. Twenty-five artificial or man-made harbors have been created in Texas alone. Industrial development has been intense along many segments of the coastal margin, particularly in the northeast, middle Gulf coast, and parts of California. Much of the industrial growth has been around bays and estuaries where harbors can be easily built.

Settlement along the coast line has increased tremendously over the past 30 years - both for year-round living and as summer shore communities. The increase has been greatest along the northeast coast adjacent to megalopolis, along the east coast and west-central coast of Florida, and along much of the California coast. Settlement along these coasts is expected to continue to increase at an even greater rate. If these rates of growth continue, it is estimated that by the year 2000 there would be two persons for every foot of U. S. coast line.

Settlement has meant extensive dredging for housing development, marinas, draining of coastal swamps, leveling of dunes, cutting of numerous artificial passes for boats and creation of fill-land. The creation of new land peripheral to San Francisco by dredging of mud from the bay floor for new housing developments is the most notable example of such activity in the United States.

It is estimated that the demand for outdoor recreation has increased in the post-war period at five times the rate of increase of population and income. The major pressure for outdoor recreation, especially in the heavily populated areas of the northwest, and the midwest takes place along the coast line - for camping, boating, fishing, and just plain romping on the beach. Anyone who has attempted to enjoy the many beaches along our shorelines can appreciate the mass migration to the beaches on weekends.

On the continental shelf, the extraction of mineral resources from substrata already is underway on a large scale - more than 8,000 oil and gas wells have been drilled on the shelf on the north Gulf coast. Exploration for mineral resources of all types will increase and increased production can be predicted. Though production has been greatest in the Gulf, Georges Banks in the Atlantic and the shelves of the Bering and Arctic Ocean show greater promise.

SUMMARY OF FOREGOING EXISTING AND POTENTIAL PROBLEMS, OPPORTUNITIES, AND NEEDS IN THE MULTIPLE USES OF THE COASTAL ZONE

PROBLEMS -

Premise

Attainment of the best use of the Coastal Zone may be one of the major resource problems of our age. The problem arises from multiple use of the Coastal Zone due to the quantity and quality of uses, often conflicting, to which man is subjecting this area in relation to the short-term and long-term natural phenomena and conditions of this Zone. It is a problem not only of human ecology--biologic, sociologic, economic, and politic--but also of the ecology of the Coastal Zone. The time for a more intelligent, coordinated utilization of our coastal resources is already upon us.

General Background

Fisheries statistics indicate that in certain locations there has been a decrease in the total harvest as man has increasingly polluted that part of the Coastal Zone. Even though the correlation of these situations may not be validated for the entire Coastal Zone, there is sufficient evidence for increasing concern of the derogating effects of the increase in both occurrence and magnitude of dumps at sea (solid and sewage wastes of municipal origin and chemical wastes from industry), oil spillage, and channel dredging. Furthermore, we should not underrate the value of a healthy human environment or the opportunities for healthy outdoor recreational pursuits. Although present food supplies are sufficient to maintain the health of our present population, we should further explore the Coastal Zone for sources of protein and fresh water as well.

Suggestions

The present magnitude and frequency of occurrence of the various uses of the Coastal Zone should be tabulated and projections be made, at least to the year 2000, of the impact of these upon man and upon the coastal environment. An attempt must be made to equate these use parameters in terms suitable for systems analysis. It might be well to test the results of this attempt in a relatively small area, as the Delaware River estuary or the Narragansett Bay area, where some information already is available.

OPPORTUNITIES -

Premise

Proper and full use realization of the bounties of the Coastal Zone may depend primarily upon the manner and pattern in which we develop our uses of the Coastal Zone. The opportunity, therefore, is to achieve sufficient sophistication so that maximum utilization can be achieved. To do this research coordination, regional use planning, and regional management must be achieved at a level never undertaken previously. Indeed, it is already obvious that the scope should be extended to the continental shelf. For instance, international agreement must be obtained on coastal uses and management, or else uncontrolled exploitation could damage the resource or

area involved.

General Background

There are a number of private and public educational and research institutions involved in the study of the coastal area. Other organizations of national or regional scope, each primarily active in projecting and/or protecting its special interest, are equally interested in the Coastal Zone. Each of these institutions or organizations have connections with or counterparts in State and Federal agencies. The challenge is to develop greater support of each entity along with increased cooperation and collaboration, all within the democratic process. One newcomer to participating agencies is the Sea Grant College program.

Suggestions

Prepare a timetable for the development of research and education, of planning, and of management of mutiple uses of the Coastal Zone. Recommend increased federal support of the Sea Grant College program and other educational-research programs designed to promote an understanding of the complex problems in multiple use and/or the planning, development, and management of coastal resources. Suggest a format for a national forum for the resolution of problems. Recommend a program of information storage and retrieval.

NEEDS -

Premise

In order to better formulate a National approach to multiple use of coastal areas at least three historically interrelated kinds of information should be better enunciated and understood: (1) What natural events have and will continue to occur? That is, what is the fundamental nature of the Coastal Zone sans the effects of man? (2) What is the impact of man upon the Coastal Zone? (3) What impact has the coastal area had upon man? Although there is not a single reference source providing an adequate historical background to these three questions, this kind of information can be obtained. The need is to put the questions into the framework of recognized problems of today and then to project them into the future. Wherein the historical background would aid in the evaluation of our current status and in the projection, it should be employed.

Background

Before the arrival of the white man in North America, Indians utilized the coastal areas as a source of food - seafood, game, and crop growing - and the water as a means of travel. Their mode of living permitted them to leave coastal areas seasonally or whenever they sensed danger in weather changes. The pattern of colonization by our forefathers and their mode of living, particularly their established communities and dependence upon water power for industry and water routes for transportation and communication, is still reflected in political boundaries. From this beginning and developing cultural aspects, the coastal areas have had a lasting effect upon political, social, and economic life in states bordering large bodies of water.

Suggestions

Review the three questions poised above and reduce to tabular or other summary form the following kinds of information:

1. Human activities in and uses of the Coastal Zone versus the economic, social, and/or political value (justification) of these uses;
2. Recommended use priority;
3. Impact of the uses upon the environment;
4. Evaluation of present levels of understanding or attainment for each use by research, management, and/or legal aspects;
5. Future needs, scope, and subjects of research, management, legal, economic, and other use aspects;
6. Geographical scope of problems;
7. Critical (geographical) areas and problems, from ecological as well as political, social and economic viewpoints.

INTER-RELATIONSHIPS OF COASTAL ZONE USES

The Task Group next turned its attention to the many uses of an activities within the Coastal Zone, and considered a method to define and isolate them and to determine their relative compatibility (or incompatibility).

It is noted that the matrix approach has been used in a number of studies involving multiple factors of uses such as the "Economic Study of the Narragansett Bay" and the "Shoreline Utilization in the Greater Seattle Area - A Case Study." Also, Niels Rorholm concluded in "Economic Impact of Narragansett Bay" that; (1) a multiple-use resource is probably not producing services efficiently unless use conflicts occur, (2) most conflicts will center around shoreline use, and (3) the resolution of shoreline conflicts involving physical space conflicts over a long period of time, should receive more public attention. He used a matrix in determining conflicts of major uses of the Bay and its shoreline by showing (1) long-term space conflicts, (2) short-term space conflicts, and (3) nuisances. It should be pointed out, however, that the elusive concept of standards criteria and definitions of all the factors involved in such a study has not yet been made. On the other hand, an economic study of the Coastal Zone appears feasible because the common denominator of dollar value is more easily grasped. However, even here some difficulty is noted in these studies when such factors as quantifying human values and aesthetics have not been decided upon. However, despite the uncertainties presently known in such an attempt to quantify the uses and their compatibility, the Task Group suggests a methodology of making this determination. If the relative compatibility and incompatibility of the various uses of the Coastal Zone can be determined, it is suggested that more effective planning and programming can be brough to bear to:

1. Improve the compatibility of various uses by providing new opportunities for multiple use.
2. Reduce conflicts which occur between uses, user groups and activities in the Coastal Zone.

3. Recognize incompatible uses for future study or to indicate leads in which to channel resources and assets away from the incompatible areas and into the more promising ones.

MAJOR USE CATEGORIES

The Task Group suggests thirteen use categories in pursuing the aforementioned matrix study of Coastal Zone uses. More attention must be given to formulating a systematic description of Coastal Zone uses, since the way uses are identified has a major bearing on the way problems are perceived, and consequently, on the manner in which public policy formulation takes place.

The Task Group recongnized that other classification systems are possible, and indeed have appeared in published reports. However, it is suggested that the uses of the Zone, or activities carried on there, be grouped under the thirteen major headings as follows:

Urbanization	Agriculture
Industry	Power Production
Transportation*	Water Supply
Mining	Recreation
Waste Disposal	Commercial Fishing
Pest Control (predominantly insects)	Research and Education
Defense	

*Includes land, air (airports) and water

It is further suggested that a matrix-type analysis of multiple use, using the above named categories, could be employed to determine their relative compatibility and non-compatibility. Herein, therefore, presents an opportunity for further sophisticated study and research in an effort to obtain the aforementioned objectives.

ECONOMIC VARIABLES

Discussion of multiple uses would be incomplete without attention being given to the economic considerations of the Coastal Zone. Why should we include sections on economic and non-economic variables? As idealistic as we are are, implementation of plans and programs ultimately are translated into the budget documents of interested agencies. Dollar amounts, priorities,and financing must be addressed and provided for. Who pays and how, are essential questions that must be answered. The proposals that generate from this Report, if implemented, will require financing--for there is a dollar cost, direct or indirect, that is inherent. The material presented herein are itemized considerations that are pertinent. Inferentially, a coordinating mechanism for planning and management would include such items in its programming. The following material on economic and non-economic variables is attributed to "Economic Impact of Marine-Oriented Activities--A Study of the Southern New England Region," by Niels Rorholm, H. C. Lampe,

Nelson Marshall, and J. F. Farrell. Liberal use of quotations from this work is included here. The implications and applicability to the Coastal Zone is apparent.

> "One of the severe problems of many rural communities is their lack of an adequate resource base--or sometimes their failure to use properly the base they have...."
>
> "Human and capital resources are mobile and are becoming more so. They have a tendency to move toward places where they get the highest reward in monetary or in other terms. Such places are either rich in extractable resources, have a location advantage in the factor or product market, or have a favorable man-made or natural environment. To the extent that this environment can attract other resources, it is itself a resource which can be used by a community to further whatever objective or objectives can be expressed through community action. In many of the coastal communities in the United States, the environment created by the meeting of the land with the sea and access to the ocean itself constitute their major, and sometimes only, natural resource base...."
>
> "It is important that information be made available that will assist in the planning and use of these resources, for they constitute an important financial base for the local communities from which to meet their expenditures for schools, welfare and general government operation, as well as an important base for economic development of the business and industry...."
>
> "Every coastal area is a complex of natural features which tends to influence the economic development of that region...."
>
> "Economic impact--the effect of a general change in a region's economy or the effect on the whole of a change in part of its economy--may be measured in a number of ways. One rarely finds an impact study which is without promotional bias. There are so many ways of measuring impact that it is not difficult to select one that suits a particular purpose or to omit measures that would cast those purposes in an unfavorable light...."
>
> "Eight different measures of economic impact have been applied to the marine industries of the Southern New England Marine Region,.... (i.e. total sales; local value added by various sectors such as industry; labor; capital; net exports; personal income; total business generated by export demand; personal income generated by export demand.)...."
>
> "From an economic analysis of a given sector, it may be concluded that a rough blueprint for development would include:
>
> 1. Work to attract industrial and research firms to suitable locations. Suitability would generally include docking facilities; good transportation and communication facilities; and good living conditions; which in turn means safe and clean communities, good schools and reasonable

proximity to cultural and recreational facilities. Last but not least, todays suitable industrial location must be close to universities and other research facilities.

2. Encourage the development of certain industries to the maximum extent permitted by the resource and the demand for products. This will probably, in time, include the managed production of high-priced items, such as shellfish and perhaps selected finned fish.

3. Protect the environment that forms the basis for all summer tourist activity, so that this economic activity may flourish, but also protect the community and its tax payers from the increases in social service costs which follow in the wake of haphazard, laissez faire economic developments...."

NON-ECONOMIC VARIABLES

"The quality of community life does not depend upon economic activity alone. In fact, the human environment can be as effectively destroyed by economic activity as can the environment for aquatic plants and animals...."

"We do not, unfortunately, have precise measures of such elusive concepts as "quality." We have, however, some measures of community costs. These costs reflect the demands made on the community either to maintain or improve an environment or perhaps the unwillingness of communities to permit the environment to degrade...."

"The differences in community costs were evaluated with the aid of straightforward analysis of variance. Information on expenditures for: (1) assessed valuation, (2) debt outstanding, (3) receipts, (4) total expenditures, (5) public welfare costs, (6) educational costs, (7) police costs, and (8) fire proctection costs...."

"While community costs are important in reflecting services required, the effect of development on the environment is also critical...."

"Where marine economic activity is not stable or persistent, the opportunity for encroachment of general industry exists. Where, because of locational and/or pricing advantages this takes place, the marine history of a community can result in the deterioration or diminution of marine resources...."

"The character of economic development obviously influences a community for extended periods. The costs of retrieving marine resources once lost may be high and the quality of the environment essentially reduced...."

"Where communities ignore the extended consequences of development, the very character of the environment may be altered. .... The point at issue is not one of maintaining or resurrecting the "status quo" but one of controlling the environmental change. This can be done only by careful selection of the quality and volume of enterprise permitted or encouraged...."

"Each community has the opportunity to control, to a considerable extent, the character of development. Zoning laws and building codes are powerful tools when they are applied and enforced. They are powerful tools whether selectively employed or ignored. Given the limited professional competence and foresight of much community management, the uses of zoning is not always effective. The emphasis on revenue production by real property taxes often leads towns to favor development that is detrimental to all but a small part of the community. In rare, but heartening instances, communities have been able to withstand the onslought of major enterprises, private and public, that have sought to modify the environment. The lure of income is often so great that community costs and reduction in community quality is ignored...."

"The ability of communities to shift costs to others also permits anomalies in development. The disposal of sewage and smoke are obvious areas of shifting burdens. The traffic and school problems of neighboring communities are often also changed. The aesthetic values of one community can and are being changed by activities in another - not always for the worse...."

"The direct and indirect influences on non-economic variables of economic change are cruicial in considering community development. Any input-output analysis must recognize the constraints placed on development of the non-economic factors. Unless attention is given these constraints, the prospects for rational development are small indeed...."

In "Shoreline Utilization in the Greater Seattle Area--A Case Study," conducted by Management and Economics Research Incorporated for the National Council on Marine Resources and Engineering Development, effective utilization of the shoreline implies that long run social and economic benefits derived from its use are maximized. This maximization must be accomplished subject to two important constraints; (1) the length and characteristics of the available shoreline, and (2) the compatibility of various uses of the shoreline. Changes in either of these constraints is possible through dredging and land-filling, and may or may not increase the long-run benefits derived from the shoreline. Changes that result in increased compatibility of various uses, however, nearly always result in increased potential benefits from the shoreline. The results of the compatability evaluation conducted of 9 use categories, as part of the Study, support the premise that multiple uses can result in increased benefits from shoreline areas. On the other hand, they also demonstrate that uncontrolled development can result in haphazard and ineffective utilization of this valuable resource.

Multiple uses of shoreline areas are essential if social and economic benefits from the resource are to be increased. The use of technology to improve the compatibility of various users can provide new opportunities for multiple use and reduce conflicts which have heretofore existed between user groups. Technology offers an opportunity to increase the compatibility with other uses of the shoreline, waste treatment, underwater facilities, management methods through computers, instrumentation, cargo handling methods, ship design characteristics, mineral exploration and production, nuclear and power plants. Also local, state and federal rules, regulations, laws and programs play a significant role in avoiding or resolution of waterfront area conflicts.

The Study concluded that the impact of technology on shoreline utilization was significant and included:

1. Benefits of technology accrue from increases in the quantity of useable shoreline, improved efficiency of utilization, increased compatibility of uses, and improved management methods.
2. Incorporation into development plans of changing location demands for terminal facilities, mineral exploration and production, and nuclear power plants.
3. Federal incentives to encourage regional planning and coordination of port facilities would be appropriate; and that regulatory activities of the Interstate Commerce Commission and the Federal Maritime Commission should be coordinated to ensure compatibility of rate structure for ocean and land transport.
4. The Technology for improving fishery yields and waste treatment methods will not move ahead without strong federal involvement.

The Task Group feels that somehow there most be achieved a rational balance in the Coastal Zone of the economic and non-economic variables.

IMPLICATIONS OF MAN'S USE OF THE SHORELINE

The history of our nations's growth has been based in large measure on a freedom of action for the individual heretofore unknown in the annals of civilization. Individuals and groups of individuals acting in consort have had freedom to attack the frontier, freedom to plan and develop, and most of all the freedom to use the natural resources of our land almost at will.

Development along our Coastal Zone line, as in evidence in other parts of the nation, has proceeded with few restraints - man has located on and used the coastline in direct proportion to his ability to buy and develop property. For example, on land much of man's activity within his own domain affects only those other persons either on adjacent property or nearby (we will not get into the matter of air pollution here). Wherever man uses water resources, inland or on the coast, he affects distant neighbors more than he does when he uses land along. Far-reaching effects from local developments may also be felt downstream on inland rivers. Along the coastline an activity or situation at a certain locality can affect many persons elsewhere along the coastline, often far removed. Longshore currents are prominent along all segments of our coastline. The longshore currents, the coastal winds and the sediments entering the coastal maring counteract to maintain an energy balance. The biota along the coastline occupy natural habitats that are controlled by depth of water and physical, chemical and energy characteristics of the water in the sea, the bays, and the estuaries. The waters of the coastal margin yield most of the seafood taken from the ocean - commercial seafood is most abundant in coastal waters. Fortunately, the Coastal Zone is less unique in transmissibility of effects than most inland rivers and lakes. The effects of pollution, adversions, consumptions, and withdrawals have a much greater range on rivers and lakes than they do along the ocean.

Man's activity in recent years has upset the natural balance along some segments of our coastline. Is it wrong that man has distrubed this balance? Our forefathers upset the natural balance when they peopled the West. As our nation grows, it is inevitable and proper that adjustments to the natural regime will occur. The point to be stressed here is not to preserve the "status quo" but to understand and influence the inevitable changes in a rational way. The cutting of channels, and dredging and placing of jetties often has been done without knowledge of current patterns and sediment distribution and resulted in erosion of barrier islands off the coast to the detriment of navigation and property.

Industrial wastes, including thermal waters, have been dumped into some of our estuaries to the extent that shellfish have been either exterminated or rendered unfit for use by contamination. For example, oysters along the New Jersey coast were recently found to contain toxic quantities of zinc after outbreaks of illness from eating these shellfish. Perhaps the most undisciplined use of the coastline has been in the matter of settlement. The sandy plains offers little resistance to storm action and all of our sandy plains coastlines lie in the hurricane belt. Not only is settlement taking place in low areas susceptible to flooding but in many places dunes, the only natural barriers to flood tides, are being flattened in the settlement process.

Increased use of the coastline can be as surely predicted as population increases. Increased engineering along the coastline and exploration for minerals on the shelves will bring increased need for more accurate maps of large scale - man's modifications and settlement along the coastal strip necessitates revision of coastal topographic maps every few years. Land-use classification of the coastline must be considered - should we restrict segments of low-lying coastline, that are susceptible to high storm damage, to recreational use? Shall we allow pollution of our inshore waters to ruin both commercial and sport fishing? How are we to handle great masses of sea floor sediments during mining on the continental shelf? How are we to deal with open cut mining along the coastline where disturbance of the fresh water table may cause salt water encroachment and ruin potable water? Shall we continue to build homes on fill land in areas of high earthquake hazard - who will be responsible here - developers, or home owners - or the U. S. taxpayer? These and many more questions must be answered in the next few years if we are to use our coastline wisely. Most of us would prefer to see not only our coastline but also the entire Coastal Zone developed in the manner that is most beneficial to all. Concerning the role of the law in planning for its use, two general needs seem pertinent: we will need addi- restrictive covenants bases on sound scientific principles to guarantee the efficient use of the coastline and for this we need both the awareness and the will of the legal profession; however, the short and simple point of the matter of the law and the Coastal Zone is that the legal profession should not wait for the human crisis on the coastline, it should assume a leadership role in anticipating it.

LEGAL CONSIDERATIONS

A review of the legal basis for Coastal Zone planning, development, and management would include both land and water-use regulations, Federal and

state. Such broad categories would include economic development, conservation, recreation, and preservation. Specific questions for review would include such items as:

Land Acquisition: For public parks, recreation, conservation, watershed protection, flood prevention, and port and urban development.

Land Use Regulations: Federal and state tax powers; equability and reasonableness protection of the private property owner; effect on land values; zoning laws, permits, and regulations.

Bulkhead Lines: Dredging or filling; navigation; conservation and protection.

Wetlands Protection Laws: Protection and conservation of ecological values; wharves, piers, port and harbor waterfront facilities; permits; promotion of navigation and commerce; construction.

Dredging and Filling: Navigation, ecology and hydrology effects in protection of Coastal Zone segments such as water pollution, fish and game, waste disposal, tidelands and submerged lands. The question of applying the Rivers and Harbors Act of 1899 for navigational permits to deny application for purposes other than navigation is presently in the courts to decide.

Present statutes, if adequately and vigorously enforced, will do much to alleviate some of the problems discussed in the foregoing parts of this report. Some of the laws would include the following listing:

Federal Water Pollution Control Act
(33 USC 466 et seq) - pollution abatement

Outer Continental Shelf Lands Act
(43 USC 1331-1343) - pollution abatement, navigational safety, conservation and development

Rivers and Harbors Act of 1899
(33 USC 407) - facility construction in navigable waters, modifications to navigable waters

Refuse Act of 1899
(33 USC 407) - pollution abatement

Oil Pollution Act of 1924 - oil pollution

Oil Pollution Act of 1961 - oil pollution

Fish and Wildlife Coordination Act
(16 USC 661) - protection of wildlife resources

Executive Order 11288 of July 2, 1966
control of waste pollution from Federal installations

Executive Order 9634 of September 28, 1945
fishery conservation

P.L. 88-308 - prohibits foreign fishing in U. S. water

P.L. 89-658 - prohibits foreign fishing in 9 mile contiguous zone

International Fishery Agreements and Conventions
fishery conservation

Merchant Vessel Navigation and Inspection Laws
(46 USC several Parts) - anti-pollution effects

Port Security Regulations (33 CFR Parts 1, 6, 124-126)

ZONING CONSIDERATIONS

In a paper "Utilization of the Estuarine Zone in Georgia" prepared by biologists from the Division of Biological Sciences, University of Georgia and submitted to the Federal Water Pollution Control Administration, it was recommended that five types of use Zones with separate buffers be established in the estuarine region of Georgia. The five zones would be:

1. Heavy Industrial and Port Zone.
2. Recreation and Commercial Fisheries Zone.
3. Research Zone.
4. Light Industrial, Recreational, Commercial Fisheries and Port Zone, and
5. Wilderness Preserve, Seashore Park and Commercial Fisheries Zone.

Each Zone would be protected from the adjacent zone by a buffer zone. In this concept, the incompatibility of uses is recognized and these uses would be isolated from one another. Zones with limited use would be small and areas with many uses would be large, and that present use should provide the basis around which further development should be planned. Thus, a concept has been proposed for the development of the estuarine region of Georgia and the pollution loads which should be tolerated in the various zones.

This is an interesting concept on zoning and has considerable merit for consideration in principle. Zoning within local, state, and Federal jurisdiction take place on a limited scale now.

NATIONAL POLICY ON COASTAL ZONE LAND DEVELOPMENT

I. Short-term Strategy - Proposal for Establishing a National Coastal Zone Land Development Policy

Increasingly, there is growing scarcity and, at the same time, larger than ever competitive demands for the land area along the coastal zone. These

stem from the historical development of population centers in the Coastal Zone areas, individual preferences for locating near water areas, and from economic reasons of trade and commerce. Social and economic development in the Coastal Zone land areas has occured in an unplanned fashion largely as a consequence of (a) the great number of political jurisdictions having control over the land-based activities in the Coastal Zone area, (b) the American concept of individual land ownership, and (c) the abhorrence of organized planning in this country.

American attitudes toward national planning and policy formulation are currently undergoing a transformation. For example, serious consideration is now being given to formulation of national policies affecting population distribution, balanced economic development in the United States, balanced development of rural and urban areas, national transportation systems, education opportunities, etc. This makes it possible to contemplate formulating and evolving a coherent national policy relating to development of the Coastal Zones.

Recent advances in technology have only tended to accelerate the presures of formulating such a national Coastal Zone development policy. Larger ships, containerization, new dredging and land-fill techniques have raised signifcant questions for the development of new ports, regulation of expansion or contraction of the shoreline, and individual vs. governmental exercise of property rights in abutting land areas. The cancer-like growth of the cities, and the resulting unsightly urban sprawl and deterioration of the human condition, also is a manifestation of this technological age, and the problem is most acute in the Coastal Zone area.

The development of trade and commerce centers in the Coastal Zone has provided dynamic growth points that have stimulated the creation of major financial and business centers, whose interests have since transcended maritime interests. The main centers of political power in this country are located in coastal areas, as are the principla diplomatic points serving this country's international interests. The history of these developments is well known.

Not as well defined is the competition and the conflicts that have been introduced into the national way of life as a consequence of the primary development (economic, social and cultural) in the Coastal Zone area. The ghetto problem and the urban problem are problems most highly visible in, even if they are not unique to the Coastal Zone city. The magnitude of these problems can be attributed to the very successes achieved in the Coastal Zone at the expense, some might assert, of the inland area. Seemingly the favored growth of the Coastal Zone has come to the point where it is unsustainable in the face of competitive demands from inland land areas without the intervention of rational planning efforts. And the tendency in national policy-making may be to disfavor Coastal Zone areas at a time when the problems are most severe.

To a large extent, the problems of the Coastal Zone, and especially the coastal cities, parallel those of inland areas. Thus problems of urban decay, social unrest, environmental pollution, welfare for the poor and disadvantaged are "problems" both in coastal and inland cities, although the character, ingredients, scale, remedial programs, etc. may vary significantly from area to area. Problems of this character are ordinarily attacked through national

programs that do not directly distinguish coastal area needs, or the development policies that have been established for such areas. Indirectly, the magnitude of the benefits of these national programs may be greater for a coastal area because of the significantly greater concentration of pupulation, industry - and problems - in the Coastal Zones.

The economic, social, cultural and political development of the Coastal Zone may be influenced only to a minor extent by marine activities, yet the reverse is not true. Factors exogenous to the marine system are likely to be determinative of the pattern of growth and development of marine affairs. Thus, the overall fiscal situation of our port cities will determine the portions of budgets that are allocated to port development, marine industrial development, marine educational services, social services, such as pension systems for marine public employees, or labor mediation, political administration activities, such as the creation and support of interstate or intergovernmental compacts, commissions, and boards that are essential to the orderly development of marine affairs. Marine conservation and recreational activities are areas where purely economic and budget priorities are more difficult to justify. The result has been that marine conservation and recreation activities have not received the level of funding that is in the national interest.

Studies about the Coastal Zone heretofore have largely concerned land bases activities per se or marine (water based) activities per se. This is true because of historical considerations that have influenced the development of institutional systems - governmental and private - that have viewed land and marine activities from a separate viewpoint. Even within the broad land and marine categories there tend to be specialized areas of consideration that are not effectively related one to the other. For example, urban and rural studies are undertaken for different urban and rural areas in the Coastal Zone, but are not viewed together for purposes of determining their policy implications for national policies relating to transportation, economic development, urban development, crime, poverty, and so forth. Similarly there is extensive division of responsibility for marine activities with no central source that looks across lines of responsibility.

Many land utilization studies have been made that center around the development of particular port areas. While some of these like the study on the Chesapeake Bay Area,* and the study of Shoreline Utilization in the Greater Seattle Area: A Case Study,** are comprehensive in scope for a single port area, and survey conflicting public and private demands for land, the results are not readily generalizable to other port or non-port coastal land areas. For example, conservation and recreational activities are likely to differ significantly between port and non-port areas. Many industrial marine service operations and research facilities are purposely located outside congested port areas, and much of the investment capital and labor supply of the port area may come from outside. The impacts and interrelationships of such exogenous factors outside the port system are not adequately treated in studies centering around port area development per se.

* "Chesapeake Bay Study," a multi-agency, Federal-State study in progress under the "management of the U. S. Corps of Engineers".

** Unpublished manuscript, Management-Economics Research, Incorporated, January 1968, MERI Project No. 1083.

In an occasional paper, "Selected Case Studies on Shoreline Development in the United States,"* commissioned by the National Planning Association in an ongoing study, Clifford Elkins makes the following recommendations:

> "One of the most important considerations on future use and development of shorelines is the problem of multiple and conflicting uses. The pull for shoreline activities is coming from several directions including recreation, industrial, harbors, and urban development; therefore, it is absolutely necessary that coordination and planning be maintained to the highest degree possible in all future uses of the shoreline. It is imperative that the means be developed to preserve for future generations the more vital and irreplaceable uses of beaches, harbors, and estuaries. In this regard, all possible influence should be used on state and local governments by the Federal Government to develop State Planning Commissions to work in conjunction with these local planning commissions to achieve a long-range development plan for shoreline activities."

This Task Force endorses these recommendations, and believes that there is a need for a study program that will provide relevant information upon which a national Coastal Zone land development policy, comprehensive in its scope, might be developed.

One must ask the basic question: Why should there be a separate policy of any kind for the Coastal Zone? We believe there are two basic reasons that apply here as well as to any other national policy that may require formation.

First, the reason why new policy formulation at the national level becomes important is because the problems, opportunities or needs in some area (1) are on a scale that goes beyond local resources, or (2) demand action which will have the effect of altering the status quo, both in the area under study and in other areas as well. The first proposition is self-evident, but the second is less so. However, the second may be the more crucial; it comes about because of the issue of how scarce resources are to be allocated, and how the structure of competitive situations is to be changed. Thus any area-limited and activity-limited action program is likely to be successful only when there is perception that it will contribute to the well-being of some larger system.

This point must be made - and kept firmly in mind - because most problems, opportunities or needs in the Coastal Zone land area are no different in kind from those manifested in other land areas. It makes sense to isolate and examine these in a Coastal Zone context only because it is evident that those problems, opportunities and needs unique to the Coastal Zone, strongly interact with those which are common to all areas of the United States. To optimize this allocation of resources to the unique areas, it is desirable

* "The Relation of Government Programs to Private Investment Enterprise in Marine Resources and Engineering Development," supported by National Council on Marine Resources and Engineering Development and National Science Foundation.

to evaluate these as integral elements in the mixture that comprises the "Coastal Zone."

Strong evidence would have to be advanced to justify, for example, the formulation of a separate national urban policy for the Coastal Zone unless it was part of a larger national policy covering all land areas. Thus, as mentioned before, there appears to be little that is unique in the urban problems, opportunities and needs of the Coastal Zone, even taking into consideration that some of these urban areas serve as ocean arteries of trade and commerce. What is unique about the Coastal Zone, however, is the high population density, industrial concentration, and scarcity of land compared with the rest of the United States.

Therefore, in recognition of the relative scarcity of land area, the IPON Task Group recommends that a systems analysis study be made of the Coastal Zone land area as a significant subsystem of the larger U. S. land area. Such a study should survey the total set of political, economic, social and cultural factors that are likely to bear on the development of the Coastal Zone land area for two arbitrarily defined future time periods. The Task Force suggests that five and twenty-five years be used as significant time frames. The first is usually considered as an appropriate measure of short-run activity, and the latter a measure of the long-run, where the consequences of new perturbations to the system or of new policies begin to show up and can be assessed.

The Task Group believes the value of this study will depend upon the breadth reflected in research design; therefore, it has formulated the following sets of illustrative questions which may be useful in structuring a study of desirable scope.

QUESTIONS FOR DISCUSSION IN FORMULATION OF A STUDY RELATING TO COASTAL ZONE LAND DEVELOPMENT POLICY

1. Identify the physical factors such as climate, topography, geology and water resources (including supplies that influence land development policy). What are their relative degree or strength of influence?
2. What is the nature of the social, economic and cultural problems that exist in the Coastal Zone area? What aspects of any problems are unique to the Coastal Zone, and what aspects are common to all areas of the United States? What public and private efforts are being undertaken to solve these problems? How do efforts to resolve such problems influence land development in the Coastal Zone?
3. To what extent and how do social, economic and cultural problems in the Coastal Zone interact with and influence the development of marine activities? Are separate activities required to deal with the marine components of any such problems, or are marine interests adequately considered as part of any general programs?
4. What political entities, e.g., Federal, state, regional, city, county, special district, and other local governmental bodies have political jurisdiction over the development of the Coastal Zone? In what areas does jurisdiction exist, and by what mechanisms is it exercised?

5. Is the jurisdiction of the above singular or multiple? What should be the allocation of jurisdiction in order to promote orderly development of the coastal shoreline? How should any desired changes be brought about?

6. What mechanisms exist for resolving differences that may arise when development objectives are in conflict with one another, either within a single jurisdiction or between jurisdictions? What are the criteria that should be considered in defining the "public interest" relating to land development in the Coastal Zone?

7. In what areas do non-coastal political jurisdictions or private groups have an interest in the way that coastal development is undertaken? Are these interests adequately represented in the decision-making process?

8. What governmental incentives or disincentives exist that influence the character of development of the coastal shoreline? Are these enacted into law? By what process does change occur in response to developing needs?

9. What are the priority systems that influence the development of marine activities in the Coastal Zone? What is the internal order of priority rankings guiding the development of marine activities? Are different priority systems reflected in the programs of the Federal Government? State Government? Local government? To what extent are any priority systems embedded in the law? To what extent are they a matter of administrative regulation or practice?

10. Are the priority systems that influence marine development stated in economic terms, or are provisions made for social priorities? Are the weighting systems given social priorities the same or different as economic priorities? If these are different, in what respect are they different?

11. To what extent and how does governmental fiscal tax policy influence the development of marine resources? To what extent is a state or local government jurisdiction dependent on revenue derived from marine or marine-related activities? How does any dependency affect the development of marine activities? Do conflicts exist between governmental taxing powers and the national interest in developing marine resources?

12. What kinds of public and private planning efforts should be undertaken to determine the development of the Coastal Zone land area? In what areas should submission of a plan be made a condition for undertaking development? What should be the criteria for such planning, and what should be the mechanisms for review and adoption of any plans that have been formulated?

II. Long-term Strategy - National Institute for Coastal Zone Studies

While the Task Group believes that a Coastal Zone land development study is urgently needed, and, therefore, assigns such a study high priority, there is a more basic problem involved that is implicit in the assignment to this Task Group. That is: inadequate attention is being given to viewing the overall development of the Coastal Zone from a long-range perspective.

Existing research and study of the Coastal Zone problems, opportunities, and needs - what little there has been - is highly specific, limited in terms of the missions of particular government agencies, and usually represent an effort to develop projections growing out of present conditions. While problem-oriented studies are necessary and should be continued, information transfer between areas is difficult. The continuity of study effort is irregular and is often the victim of changing political administrations.

Transportation planning might serve as an example of the deficiencies in the current processes. Transportation is used to move goods and people; there are numerous tradeoffs that must be taken into account between air, land, water and pipeline. Obviously, transportation needs are not only determined by current patterns of congestion or other problems, but by the needs of the future. Future needs are dependent on policy decisions about economic and urban development, that are made at many levels of government. The system is dynamic and interacting yet, at present, there are no effective means for viewing the coastal system in its entirety, or for measuring how current decisions in one area may affect future developments in the same area and in other areas as well. Small decisions, unless made in the context of policy guidelines for long-range development, can themselves set the terms of long-range policy.

Planning can be undertaken on the basis of "objectives," and "goals," or on the basis of studying "problems," "opportunities," and "needs."

The difference is between the general and specific approach. Both techniques are useful, but the choice of one to the exclusion of the other is likely to have vastly different consequences for development and for the character and scale of the planning process, and the manpower resources required. Moreover, the general goals-objectives approach often results in a quite different perspective as to how problems-opportunities-needs are conceived.

Generally long-term planning, especially at the national or multistate regional level, involves goals-objectives oriented planning because the passage of time is unlikely to change the statement of the goal or objective in contrast to problem planning, where time invariably alters the concept of the problem. Goals-objectives planning is particularly appropriate, too; when a great number of planning activities are already underway involving strong political prerogatives, as in the case of the Coastal Zone, and where the major deficiency may be the lack of unity and coordination mechanisms to link existing planning activities.

For a large-scale planning effort, such as required by resource planning in the Coastal Zone, the use of goals-objectives planning is vital in giving perspective and structure to problem-opportunity-need planning. Without such perspective and structure, it is difficult to define the level of problem-opportunity-need, its relationship to other related problems-opportunities-needs, and the basis for obtaining agreements as to definition to permit formulation and administration of public policy. For example, an unemployed pool of manpower can be considered in terms of a "problem," and "opportunity," and a "need."

The consequences can be quite different in terms of public policy. Considered in terms of unemployment "problem," policy formulation emphasized providing employment opportunities; in terms of "need," the orientation concerns the welfare of the unemployed. In terms of public administration, different agencies of government are likely to have cognizance over the "problem" or "need." In resource planning, in connection with a public works facility, such a pool of unemployed labor may be looked at in "opportunity" terms.

After considerable debate and consultation with staff of the Committee on Multiple Uses of the Coastal Zone and the Marine Council concerning the best

approach to fulfilling the terms of its assignment, this Task Group turned to Federal agencies to determine if somewhere, someone might have examined single areas in terms relevant to the Task Group's assignment. It found that there was no single source where it could go to discover the "problems, opportunities and needs" of the Coastal Zone. Even within a single Federal agency - or within bureaus of agencies - there was no one who could provide such information in policy-relevant terms. More importantly, the Task Force concluded (a) that there is very little possibility in the near future that agency interests might be expected to change to accommodate policy concerns such as grow out of this assignment, and (b) that even over a longer period such changes would be unlikely to materialize within the governmental structure.

Fortunately there is a model available that may be applicable to the situation in the Coastal Zone. Recently, in recognition of the importance and this need for a continuing, comprehensive overview of urban development divorced of the pressures of the political process, President Johnson announced the chartering of a National Urban Institute, private in its management, but to be financed both by public and private funding. The same congent reasons advanced for the establishment of the Urban Institute by a distinguished Presidential Commission are applicable to the need for a permanent nongovernment study capability to conduct studies applicable to the future development of the Coastal Zone region.

The Task Group recommends that a new study institution - the National Institute of Coastal Zone Studies - be created to give continuing attention to research on the "problems, opportunities, and needs" of the Coastal Zone. The chartering of this proposed Institute, as well as its method of financing, require additional consideration at the highest policy levels of the Federal Government. Therefore, this Task Group further recommends that another appropriate task group be assembled to give attention to this matter on a high priority basis. In the view of this Task Group the purpose of the proposed Institute would best be served if it included within its functions not only research and policy study activities, but also appropriate education and information transfer activities.

RECOMMENDATIONS

Due to the complexities of the multiple uses and conflicts found in the Coastal Zone, the lack of a comprehensive system to cope with these uses and conflicts, and to better understand this part of our environment, the Task Group believes immediate action is necessary. A multi-faceted approach is, therefore, suggested.

SHORT-TERM AND INTERIM ACTIONS

Certain policies can be adopted to effect immediate actions. It is recognized that some of these actions may appear too severe as they apply to exploitation of the Coastal Zone. Nonetheless, a strong preservation position is deemed necessary at this time at all levels of government if the integrity of the remaining undeveloped Coastal Zone area is to remain intact and to serve the public need for the future.

1. Defining the National Interest in the Coastal Zone:

The Marine Sciences Council should describe the broader national interest in the Coastal Zone. Examples of expression of certain elements of broad national interest are the Federal Water Pollution Control Authority's National Estuarine Study and the Estuarine Study under P.L. 94-454.

2. Defining the National Goals and Objectives Relative to the Coastal Zone:

The Marine Sciences Council should develop a statement for a national position of the role and responsibility of the Federal Government in the Coastal Zone. Legislation should be prepared so that Congress can express its interest and intent in the orderly development of the Coastal Zone by the ~~interest and intent in the orderly development of the Coastal Zone by the~~ multiple use concept. A definition is needed to develop, in cooperation with government at all levels and the private sector, our national goals and objectives in the Coastal Zone. P.L. 94-454 provides the genesis of such statements.

3. Enforcement of Water Quality Standards:

Maximum application provided by law should be made in the enforcement of water quality standards by the state governments, or by the Federal Government if the states default.

4. Use of Present Laws, Executive Orders, and Regulations:

To prevent or minimize further loss and degradation of Coastal Zone areas, but particularly the estuaries and associated wetlands and beaches, the use of such authorities should be directed for maximum application of Federal and state laws. Where necessary and appropriate, test cases should be selected for legal interpretation. Each of the coastal states should be urged to do likewise, with Federal assistance, if necessary.

5. Identifying High Value Coastal Areas:

It is recommended that the Marine Sciences Council support adequate funding for the Interior Department, the Corps of Engineers, and other agencies studying estuaries, shorelines, and other parts of the Coastal Zone. It is also recommended that the Marine Sciences Council Staff, or the succeeding ongoing organization (1) review the listing of high value coastal areas developed by these ongoing studies, and (2) take appropriate steps to recognize additional areas in order to complete the listing. Among the purposes of such action would be to assist in the identification, in consultation with the Department of State, of potential international problems, and to serve as a guide for public and private planning activity.

6. Intensifying the Review of Proposed Coastal Zone Alterations and Plans for Development of Coastal Water Resources:

The expertise among the Federal agencies, such as found in the Department of the Interior, Corps of Engineers, Water Resources Council, Health, Education, and Welfare, Smithsonian and others; for example, should be inventoried by the Coastal Zone agency for the purpose of forming a reservoir of experts that would, on a regional and national basis, serve as consultants to those agencies

that now perform this function. Further, the Coastal Zone agency should compile and maintain an updated inventory of expertise to be found outside the Federal Government and make such inventory available to the Federal agencies and states as needed.

7. Stopping the Disposal of Federal Land:

The General Services Administration should be requested to study carefully, with the Department of the Interior assistance, any proposals to sell to private interests land that might better be used for public recreational activities, for preservation of the natural environment, for the public good, and for other similar activities.

8. Additional Study of Coastal Zone Problems:

In order to more rapidly understand our environment, increased emphasis by Federal agencies in the study of Coastal Zone problems should be made. The Coastal Zone agency should prepare and circulate a listing of needed research and study in specific problem areas, and to make such required ecological studies in the conservation and protection of the Coastal Zone from destructive modifications and their effects.

9. Development of Guidelines:

The Federal Government, acting through the Marine Sciences Council, should develop broad guidelines for a Coastal Zone management plan concept. The broad guidelines should be for Federal and state guidance for assigning multiple uses, for acquiring Coastal Zone lands, for management, zoning and enforcement. The guidelines should be provided to the states and the states encouraged to use them. It is noted that the Department of the Interior is already engaged in this effort in connection with water quality standards and the Bureau of Land Management with oil and gas leases.

10. Preparation of a Handbook for Coastal Zone Problems:

The Federal Government should assume responsibility for preparing for wide public distribution, a handbook of technical information and problem areas that would serve as a guide for reviewing water development projects, proposed estuarine and wetland modifications, and conflicting uses of the environment. Specific areas or problems should be stressed and alternatives described that would, depending on the location and problems, reduce, or eliminate detrimental effects to the environment or reduce conflicts. Alternative legal procedures should also be discussed. Dissemination should include, schools, colleges, Federal and state administrations. A panel of experts and/or consultants should be assembled to prepare the text. This effort should be started as soon as possible.

11. Provisions for a Back-up Position:

In the event the courts rule that the Corps of Engineers cannot deny or condition a "navigation" permit for natural resources or pollution purposes, the agreement between the Department of the Army and the Department of the Interior of July 13, 1967, would be meaningless. This presently is the best vehicle available for conserving and protecting the Coastal Zone from destructive modifications. In the event this vehicle fails, the government would be

without recourse to prevent or temper private exploitation. The following possibilities should be explored.

a. Confirm the authority of the Corps of Engineers to consider and manditorily include conservation of fish and wildlife resources and pollution control when issuing navigation permits by amending the River and Harbors Act of 1899.

b. Amend the Fish and Wildlife Coordination Act to accomplish the same as in (a).

c. Seek new legislation that would establish a permitting system in the Department of the Interior, or in any agency dealing with Coastal Zone resources, development use, or activity that might be established. The issuance, conditioning, or denial of such a permit of proposed projects should include provisions in all cases of anti-pollution measures.

d. Seek new legislation establishing state authority for a permitting system described in (c), but within the framework of accepted Federal guidelines similar to the Federal Water Pollution Control Act. It may take years to provide for such a back-up position so this effort should not be delayed.

e. To make such ecological study in the conservation and protection of the Coastal Zone from destructive modifications and their effects.

A LONG RANGE PROGRAM

1. A permanent Coastal Zone Coordinating Mechanism:

Create a separate permanent coordinating mechanism responsible for coordinating Coastal Zone research, planning and where appropriate, management. The counterpart of such an authority may be considered for development in state and local governments.

2. Increased Education:

A new study institution--The National Institute of Coastal Zone Studies--should be created to give continuing attention to research of problems, opportunities, and needs of the Coastal Zone. A curriculum should be developed for the training of Coastal Zone planners and managers. Greater attention and increased efforts are needed in providing educational opportunities, such as fellowships, student support, training programs, public awareness; and such a program should have broad inter-discipline orientation to include research, scientific investigations, and problem orientation. The existing Sea Grant programs, the Department of Health, Education and Welfare programs, and others, where appropriate, should be reviewed for amalgamation in the new institution, where indicated.

3. Study of Coastal Zone Land Development Policy:

Initiate a systems analysis study of the Coastal Zone land areas as it relates to a subsystem of the larger U.S. land area to survey the total set of political, economic, social and cultural factors that are likely to bear on development of the Coastal Zone land area for five and twenty-five year future time periods.

4. Management Information System:

Compatibility should be assured between the data storage and retrieval system developed for the National Estuarine Study and those systems which contain data relating to the continental shelf and the coastal plain, as well as other existing and planned systems concerned with estuarine and coastal waters.

IPON TASK GROUP MISSION

This Task Group will review all of the material on this subject which has been prepared by the Council staff, the consultant panels, and others, and, to the greatest extent possible, develop new material. Basically, both problems and needs are associated with the question of development v. preservation and the desirability of working out a National policy on the matter. The Task Group will not only identify problems and needs but work out recommendations on solutions and policies for the consideration of the Committee.

The Task Group will formulate a list of major opportunities, needs, and problems as the first order of business. Subjects should be included on the list on a factual basis without bias or prejudice by the agencies with a view to present functions or responsibilities and included whether or not the situation is National, regional or local in nature.

This Task Group will identify the scientific and technical factors, including economic factors, and seek a model for solution of the problems identified.

Some of the issues which have been raised which need attention from this Task Group are attached.

The Task Group will develop position papers on a selection of these and other questions and issues which may be brought to its attention for consideration by the Committee.

Committee Membership and Operation. The Chairman of this Task Group will be supplied on a full-time basis by the National Science Foundation. The following agencies will make people available to assist in the work of this group on a part-time basis: Health, Education and Welfare, Atomic Energy Commission, Department of Transportation, Department of the Interior (2), the Smithsonian Institution, and the Office of Science and Technology. It is possible that office space can be provided by the Department of the Interior.

This Task Group will be provided secretarial and administrative support by the National Science Foundation. The Task Group advisers would be Robert Abel and Josephine Doherty.

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UNITED STATES GOVERNMENT

Memorandum

TO : Chairman, CMUCZ

5421
DATE: 3 February 1969
Serial 44

FROM : Captain W. A. JENKINS, USCG

SUBJECT: Definition of the Coastal Zone

1. In accordance with your instructions pertaining to a definition of the Coastal Zone, members of the IPON Task Group met on 31 January and 3 Fefruary 1969 to consider that question. Assisting in this work was the Chairman of the IDCOZ Task Group and representatives of the Department of State and Defense (Navy).

2. Enclosure (1) hereto, contains the results of the deliberations of this Ad Hoc group. It is understood this subject will be an agenda item for discussion at the 7 February 1969 meeting of the CMUCZ.

W. A. JENKINS
Acting Chairman
IPON T.G.

Encl: (1) Deliberations of Ad Hoc group

3 February 1969

1. Problem: To define the term Coastal Zone

2. Considerations:

a. A basic definition is central to the deliberations of the CMUCZ, its various Panels, and Task Groups, and to the Marine Science Council.

b. The definition must include a wide range of considerations, the most important of which are:

(1) Interests of federal, state and local governmental agencies; other public and private bodies, such as interagency groups including the MSC and CMUCZ comprised of some 15 agencies, the Water Resources Council, and others; and international law and policy, particularly the freedom of the seas doctrine.

(2) The definition on the seaward side would have to contain the following two primary elements: the concept of unrestricted research and scientific investigations of the oceans and the sea beds, and regulatory management which must be articulated within the meanings of the jurisdiction of the United States and within international law with economic, defense, international, and legal considerations.

(3) The landward boundary would be mainly concerned with functional and management concepts within national political boundaries, such as state and local, with additional economic, social, and watershed considerations.

c. All of the agencies represented on the MSC/CMUCZ have interests and responsibilities along that part of the Coastal Zone within that area containing lands, shoreline, and the territorial sea.

d. Some of the agencies represented have significant interests and responsibilities beyond the territorial sea boundary such as State, Defense, Transportation, Interior, and others.

e. The focus of much of the CMUCZ considerations have largely been one of federal, state, and local concern of the shoreline of the U.S., territories, and possessions, i.e., the physical interface of land and sea, including the Great Lakes.

3. Summary of Task Group's suggestions and recommendations to date.

a. COSREL: That seaboard and Great Lakes area whose use is strongly affected by the close proximity of land and sea.

b. COSREL: Seaward boundary amendment to the above as suggested by the Chairman, COSREL T.G.: Bounded on its seaward side by the outer limits of federal authority.

c. IDCOZ Physiographic Description: The Coastal Zone extends inland from the sea as far as significant marine influences are active, and as far seaward as continental influences are significant. Delineation is thus a question of characteristics of coastal environments by those influences that are distinctive and significant.

d. IPON: None recommended, but for T.G. purposes of discussion, the Coastal Zone may be taken to extend from the outer edge of the Continental Shelf to the inland edge of the coastal plain.

4. Specific Problems:

a. DOD/Navy has problems with any definition placing the seaward limit beyond the territorial seas, and accordingly suggests:

> For purposes of unilateral federal-state regulation, the seaward limit of the Coastal Zone is defined as coextensive with the outer limit of the recognized territorial sea of the United States.

b. State suggested wording on the seaward boundary:

> Bounded on the seaward side by the extent of the influences of the land for scientific research purposes, and by the extent of U.S. jurisdiction for other purposes.

5. Conclusions:

a. No attempt should be made to define the Coastal Zone for scientific and research purposes, since scientific investigations transcend political, legal, and zonal boundaries.

b. Defining the Coastal Zone from a regulatory, management, and multi-use-multi-purpose stand point presents major problems of a national, international and legal character.

c. The definition should be worded so as not to hinder the proper carrying out of the statutory functions of any federal agency, nor construed as limiting any agency's programs in the future.

d. Most of the concern of the CMUCZ in the Coastal Zone area is within the limits on either side of the shoreline.

e. Any definition should be reference only and not a legal description.

f. Any definition should contain an expression of the multiple uses within geographic concepts.

6. Recommendations:

The Coastal Zone generally comprises the area surrounding the shoreline on the sea coasts, Great Lakes, bays, inlets, and estruaries of the United States, its territories, possessions, Puerto Rico, and other areas administered by the United States, whose use is strongly affected by the mutual interaction of land and sea. The objects of research concerning the resources and uses of this area cannot be limited to any specific boundaries. However, for purposes of identifying the immediate objects of planning, management, and regulatory programs, the Coastal Zone extends landward within the States bordering on this shoreline, as far as significant marine influences are active and seaward, to the outer limit of U.S. territorial sea. It is emphasized that activities in areas adjacent to the territorial sea may have a significant effect on the use of the shoreline which may require appropriate local, national, or international measures in furtherance of Coastal Zone programs.

BIBLIOGRAPHY

"A Summary of Estuary Programs
U. S. Geological Survey
Water Resources and Geologic Divisions"
October 1967

"A Three-Ply Representation of the Major Organ Systems of a Quahaug"
Public Health Service
Bureau of Disease Prevention and Environmental Control
Northeast Shellfish Sanitation Research Center
Narragansett, Rhode Island

"A Perspective of Regional and State Marine Environmental Activities:
A Questionnaire Survey, Statistics and Observations"; (PB 177 765)
Prepared under contract to the Institute of Public Administration in
connection with their work for the President's Commission on Marine
Science, Engineering and Resources: by the John I. Thompson and Company
Washington, D.C., February 27, 1968

"Agency to Study Plan to Dump Sewage at Sea"
By LeRoy Whitman
The Washington Post
Sunday, August 25, 1968, Pg. D 11

"Agreement by Lake Michigan Basin States"
Appearing in the Congressional Record - Extension of Remarks, October 4, 1968
Pg. E 8642, G.P.O., Washington, D.C.

"Biological Oceanography"
By Carl N. Shuster, Jr.
University of Delaware Marine Laboratories
Newark and Lewes Delaware
Contribution No. 23

"Chesapeake Bay Study Group"
Minutes of second meeting, March 27, 1968
Published by Department of Army
Baltimore District
Corps of Engineers, Baltimore, Maryland

Chesapeake Report
Release, Thursday, August 15, 1968
Published by the Chesapeake Bay Foundation, Inc.
Annapolis, Maryland

Chesapeake Report
Release, Thursday, October 17, 1968
Published by the Chesapeake Bay Foundation Inc.
Annapolis, Maryland

"Coastal Plains Economic Development Region"
A Report on the Initial Action Planning Program of the Coastal Plains Regional Commission

"Coastal Zone - Issues"
A paper by Dr. Deric O'Bryan
U.S. Geological Survey
Water Resources Division
May 1, 1968

"Competition for Aquatic Environment"
By Dr. Roland F. Smith
As printed in COMMERCIAL FISHERIES REVIEW, Vol. 30, No. 5
May 1968

"Congressional White Paper on National Policy for the Environment"
Submitted to the United States Congress under the auspices of the Committee on Interior and Insular Affairs, United States Senate and the Committee on Science and Astronautics, United States House of Representatives, 90th Congress, 2nd Session, Serial T, October 1968; G.P.O., Washington, D.C., 1968

Conservation Foundation Letter
April 22, 1968, 5-68, Washington, D.C.

"Delaware Estuary Sedimentation Study"
Project report of July 11, 1967
U. S. Geological Survey

Department of Interior News Release
Remarks by Dr. S. Fred Singer
Deputy Assistant Secretary of the Interior for Water Pollution Control
Before the Oyster Institute of North America
Washington, D.C., July 15, 1968

"Economic Impact of Marine-Oriented Activities - A Study of the Southern New England Marine Region"
University of Rhode Island
Nich Rorholm, H. C. Lampe, Nelson Marshal, and J. F. Farrell
1967

"Economic Impact of Narragansett Bay"
By Niels Rorholm
Bulletin 374
University of Rhode Island
Agricultural Experiment Station
Kingston, Rhode Island
December 1963

"Effects of Water Quality--Changes on Biota in Estuaires"
Project report at Washington, D.C. and Patuxent River, Maryland
July 17, 1967
U. S. Geological Survey

Estuarine Studies of the U. S. Geological Survey

Future of Chesapeake Bay an Enigma"
In Chesapeake Bay Foundation News Bulletin
Annapolis, Maryland
April 1968

"Geologic Aspects of Sea-Water Encroachment: Recognition of Late Glacial Substages in New England and New York"
Project report of September 7, 1967
U. S. Geological Survey

H.R. 25 - Estuarine Areas, Report No. 989
From the Committee on Merchant Marine Fisheries
House of Representatives
November 28, 1967
G.P.O., Washington, D.C.

"Hydrologic - Oceanographic Interralations"
Project report at Washington, D.C. and Florida
September 1, 1967
U. S. Geological Survey

"Issue Paper - Management of the Coastal Zones, Estuaries and Great Lakes"
By S. Fred Singer
Deputy Assistant Secretary
Department of the Interior
Commission on Marine Science, Engineering and Resources
February 9, 1968

Joint House-Senate Colloquium to Discuss a National Policy for the Environment"
Hearing before the Committee on Interior and Insular Affairs United States Senate and the Committee on Science and Astronautics United States House of Representatives, 90th Congress, 2nd Session, July 17, 1968, No. 8
G.P.O., Washington, D.C., 1968

"Man and the Coastal Zone"
Remarks of James T. McBroom
Executive Secretary for the Committee on Multiple Use of the Coastal Zone
National Council on Marine Resources and Engineering Development
At a meeting of the Louisiana Intercoastal Seaway Association
Morgan City, Louisiana
April 19, 1968

"Marine Trade Zone Plan Due Toning Down"
By Clyde LaMatte
In The Houston Post, Sunday, October 13, 1968

"Managing the Environment"
Printed in the Congressional Record - House
September 18, 1968, Pg. 8956, G.P.O.
Washington, D.C.

"Marine Frontiers"
An address by Hubert H. Humphrey, Vice President of the United States
At the Conference on Marine Frontiers, sponsored by the New England
Council and the New England Marine Resources Information Program
At the University of Rhode Island
Kingston, Rhode Island
1967

"Marine Hydrology and Geochemistry"
Project report at Woods Hole, Massachusetts and Washington, D.C.
U. S. Geological Survey
August 1, 1967

"Marine Resources Conservation and Development Act"
Hearings before Special Subcommittee on Submerged Lands of the Committee
on the Judiciary, House of Representatives, 90th Congress, 2nd Session
G.P.O., Washington, D.C., 1968

"Marine Resources of the Atlantic Coast"
Atlantic States Marine Fisheries Commission
Tallahassee, Florida
Leaflets 1 to 8 inclusive
October 1965

"Marine Science Affairs"
The President's message to the Congress transmitting his Second Annual
Report on Marine Resources and Engineering Development
March 11, 1968

"Movement of Radionuclides in the Columbia Estuary"
Project report at Portland, Oregon
Columbia River Estuary of
September 12, 1967
U. S. Geological Survey

"National Estuarine Inventory - Handbook of Descriptors"
Proposed by T. A. Wastler and L. C. de Guerrero
U. S. Department of the Interior
Federal Water Pollution Control Administration
Division of Technical Services
Office of Estuarine Studies
Washington, D.C.
June 1968

"National Parks and Landmarks"
Unites States Department of the Interior
National Park Service, 1966

"Ocean Disposal of Waste Material
By Ralph W. Buelow
Contribution No. 28
From Northeast Marine Health Sciences Laboratory
National Center for Urban and Industrial Health
Bureau of Disease Prevention and Environmental Control
Public Health Service
Department of Health, Education and Welfare
Narragansett, Rhode Island

"Our Environment and Public Policy"
Appearing in Congressional Record - Extension of Remarks
October 28, 1968, E9456, 57
Speech by Congressman Jeffrey Cohelan
At Aspen, Colorado, August 25, 1968

"Return to the Sea"
A pamphlet published by United States Department of Health, Education, and Welfare
Public Health Service
Washington, D.C.
August 1967

"Rhode Island; Official Highway Map"
1968

"Sediment Movement and Bottom Conditions in the Atlantic Coast Estuarine and Nearshore Waters"
Project report at Washington, D.C. and Philadelphia, Pennsylvania
October 2, 1967
U. S. Geological Survey

"Selected Case Studies on Shoreline Development in the United States"
By Clifford Elkins
National Planning Association
September 27, 1967

"Shoreline Utilization in the Greater Seattle Area: A Case Study"
Prepared for National Council and Marine Resources and Engineering Development
By Management and Economic Research, Inc.
January 1968

State of Maine, J.P. 612 - L.D. 1597
An Act to Regulate the Alteration of Wetlands
Approved June 5, 1967
Chapter 348 Public Law
Page 634-1

"Study of Means for Minimizing the Danger of Pollution of the Marine Environment Which Might Arise from the Exploration and Exploitation of the Sea-bed and Ocean Floor and the Subsoil Thereof"
Iceland's proposed draft resolution before the United Nations, New York, N.Y.
October 28, 1968, In Department of State Telegram USUN 7390

"That Delicate Balance"
Printed in the Chesapeake Bay Foundation, Inc.
News Bulletin, Vol. 1, No. 2, July 1968
Annapolis, Maryland

"The Ecology of Wetlands in Urban Areas"
By William A. Niering
May 1968

"The Federal Role in Water Transportation Planning"
By Philip E. Franklin
Coordinator for Water Resources, Department of Transportation
Remarks at the First Minnesota Seminar on Waterborne Transportation Planning
St. Paul Minnesota
January 16, 1968

"The Influence of Industrial and Municipal Wastes on Estuarine and Offshore Water Quality"
Project report at Tacoma, Duwamish River and four areas in Puget Sound, Washington
Dated July 1, 1967
U. S. Geological Survey

"The Nature of Tidal Marsh"
By Carl N. Shuster, Jr.
U. S. Department of Health, Education and Welfare
Contribution No. 16
From the Northeast Shellfish Sanitation Research Center
Narragansett, Rhode Island
As printed in Information Leaflet
New York State Conservation Department
Division of Conservation Education
August-September 1966 issue

"The Nation's Water Resources; the First National Assessment of the Water Resources Council"
Parts 1, 4, 5 and 6
Washington, D.C.
November 1968

"The Outer Continental Shelf: Its Promise and Its Problems"
Appearing in Congressional Record - Extension of Remarks
November 1, 1968, Page E9690-93
By Under Secretary of Interior David S. Black
Speech before the 18th Annual Convention of the Gulf Coast Association of Geological Societies

"Transient Flow and Saline Intrustion in Rivers"
Project report at Arlington, Virginia
July 13, 1967
U. S. Geological Survey

"Utilization of the Estuarine Zone in Georgia"
Article submitted to the Federal Water Pollution Control Administration as a contribution to the National Estuarine Pollution Study
By biologists from the Division of Biological Sciences
University of Georgia
March 14, 1968

"Waste Disposal in United States Assailed"
By Joseph G. Herzberg
In The New York Times, Sunday, October 20, 1968

"Water Resources of the Everglades National Park, Florida"
Project report at Miami, Florida
July 10, 1967
U. S. Geological Survey

"Water Quality Improvement Act of 1967"
Appearing in Congressional Record - Extension of Remarks, November 1, 1968,
Pg. E9685, Remarks in the House of Representatives, Monday, October 14, 1968
By Honorable Ed Reinecke

"We Have Overengineered Our Environment"
By Irston R. Barnes
In The Washington Post, Sunday, August 25, 1968
Pg. E 8

"Wild and Scenic Rivers Act"
Public Law 90-542, 90th Congress
S. 119, October 2, 1968

"Will We Destroy the Web of Life?"
By William Hines
In The Sunday Star, Washington, D.C.
September 29, 1968
Pg. PC-4